



iCrash :
A Crisis Management Case Study
MESSIR Analysis Document
- v 1.4 -

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Chapter 1

Introduction

1.1 Overview

iCrash is a simple system dedicated to any person who wants to inform of a car crash crisis situation in order to allow for crisis handling. At anytime and anywhere, anyone can be the witness or victim of a car crash and might be in a situation allowing for alerting this crisis. The *iCrash* system has for objectives to support crisis declaration and secure administration and crisis handling by the *iCrash* professional users.

1.2 Purpose and recipients of the document

This document is an analysis document complying with the **Messip** methodology [?]. Its intent is to provide an example of a precise specification of the functional properties of the *iCrash* system.

The recipients of this document are:

- the *iCrash* system's buyer company (ABC): this document is used as a contractual document jointly with any other document considered as useful (as requirement elicitation document, ...) in order to have a higher degree of precision in requirement description. It is also used as a basis document for the *iCrash* system validation using specification based testing.
- the *iCrash* system development company (ADC) is expected to use this document as the basis for development (mainly design, implementation, maintenance). It is also used for verification and validation using test plans defined using the analysis models described in this document and according to the **Messip** methodology.

1.3 Application Domain

The *iCrash* system belongs to the Crisis Management Systems Domain. It is a system dedicated to crisis professional and non professional end users. It has to be considered as an autonomous and external service for the society. It is not an institutional system certified and guaranteed by any governmental entity and thus, must be used with caution.

1.4 Definitions, acronyms and abbreviations

N.A.

1.5 Document structure

The document structure is designed to be coherent with the **Messip** methodology [?]. Section 2 provides a general description of the system purpose, its users, its environment and some general non functional requirements. A more detailed description of the non functional requirements, if any, are provided in section ?. The **system operation** triggered by events sent by the external **actors** belonging to the environment are described in Section 3. The *iCrash* concepts used to represent the any persistent or transient information is given in Section 4. The precise specification of the system operations in term of system's state changes, events sent together with the constraints on the allowed sequences of system operations are described in Section 5.

Chapter 2

General Description

In the context of the **Messip** method, the information provided in this section is intended to present the system for which the **Messip** analysis is provided. The content of this section is made accordingly to the requirements elicitation document that might have been done during the project but also adapted coherently in order to be an abstract introduction to the **Messip** analysis.

2.1 Domain Stakeholders

All stakeholders of the system are detailed in this section. After a brief description of a stakeholder, its objectives are first stated. Thereafter, the responsibilities of the stakeholder are detailed which help to achieve the stakeholder objectives to a certain degree. While the objectives characterize the general problems addressed by the *iCrash* system, the responsibilities describe concrete actions that are expected from a stakeholder. Some of these responsibilities can be traced looking at the use case described in Section B.1, and hence must be supported by the *iCrash* system. All stakeholders listed in this section have an interest in the system or are affected by the system in some way, but only a subset of the stakeholders are directly involved in the use cases described. Let us remind that use case diagrams or descriptions are not **Messip** analysis phase mandatory outputs. They are proposed as informal means to help understanding the semantics of the system specification made of the mandatory analysis models, which provide a complete executable specification.

2.1.1 Communication Company

A Communication Company is a company that has the capacity to ensure communication of information between its customers and the *iCrash* system. The objectives of a Communication Company are:

- to be able to deliver any SMS sent by any human to the *iCrash* 's phone number.
- to be able to transmit SMS messages from the ABC company that owns the *iCrash* system to any human having an SMS compatible device accessible using a phone number.

In order to achieve these objectives, the responsibilities of a Communication Company are:

- ensure confidentiality and integrity of the information sent by a human to the *iCrash* system or from the system to a human.
- to be always available and reliable.

2.1.2 Humans

A human is any person who considers himself related to a car crash either as a witness, a victim or an anonymous person. The objectives of a human are:

- inform the *iCrash* system about the crisis situation he detected.
- be sure that the ABC company has been informed about the situation.
- to be informed about the situation of the crisis he is related to as a victim or witness.

In order to achieve these objectives, the responsibilities of a human are:

- to provide as much details as possible concerning the crisis to the ABC company.
- to declare a crisis only if the crisis is real.
- to have access to the SMS compatible communication device he used to communicate with the *iCrash* system.

2.1.3 Coordinators

A coordinator is an employee of the ABC company being responsible of handling one or several crises. The objectives of a coordinator are:

- to securely monitor the existing alerts and crisis.
- to securely manage alerts and crisis until their termination.

In order to achieve these objectives, the responsibilities of a coordinator are:

- to be capable to determine how an alert received should be considered.
- to be available to react to requests to handle alerts and crisis.
- to be autonomous in handling crisis and to report on its handling.
- to be able to decide when a crisis or an alert can be closed.
- to know its system identification information for secure usage of the system.

2.1.4 Administrator

An administrator is an employee of the ABC company being responsible of administrating the *iCrash* system. The objectives of an administrator are:

- to add or delete coordinator actors from the system and its environment.

In order to achieve these objectives, the responsibilities of a coordinator are:

- know the company employees that can be coordinators and that have access to the system.
- to know its system identification information for secure usage of the system.
- to know the security policy of the ABC company.
- to communicate the coordinators their identification information for secure system usage.

2.1.5 Creator

Any system has a `Creator` stakeholder which is a technician who is installing the *iCrash* system on the targeted deployment infrastructure.

The objectives of a `Creator` are:

- to install the *iCrash* system
- to define the values for the initial system's state
- to define the values for the initial system's environment
- to ensure the integration of the *iCrash* system with its initial environment

In order to achieve these objectives, the responsibilities of a `Creator` are:

- provide the necessary data to the *iCrash* system for its initialization.

2.1.6 Activator

An `activator` is a logical representation of the active part the *iCrash* system. It represents an implicit stakeholder belonging to the system's environment that interacts with the *iCrash* system autonomously without the need of a external entity. It is usually used for representing time triggered functionalities.

The objectives of a `activator` are:

- to communicate the current time to the system
- to notify the administrator that some crisis are still pending for a too long time.

In order to achieve these objectives, the responsibilities of a `activator` are:

- to know the current universal time
- to send the messages to the system according to the time constraints specifically defined for it.

2.2 System's Actors

The objective of this section is not to provide the full requirement elicitation document in this section but to reuse a part of this document to provide a informal introduction to the **Messir** specification of the system under development. The use case model is made of a use case diagrams modelling abstractly and informally the actors and their use cases together with a set of use cases descriptions. In addition, those diagrams and description tables are adapted to the **Messir** specification since actor and messages names together with parameters are partly adapted to be consistent with the specification identifiers (see [?] for more details).

Among all the stakeholders presented in the previous section, we can determine five types of direct actors¹:

- `actComCompany`: for the Communication Company stakeholder.
- `actAdministrator`: for the Administrator stakeholder.
- `actCoordinator`: for the Coordinators stakeholders.
- `actActivator`: for the Activator stakeholder.
- `actMsrCreator`: for the Creator stakeholder.

In addition to those system actors, we can add five other types of actors related to the system's ones. Those five actors are grouped into two categories:

- *Indirect actors*
 - *Witness*: for any human that is a witness of a car crash
 - *Victim*: for any human that is a victim of a car crash
 - *Anonymous*: for any human that want to inform about a car crash while staying anonymous.
- *Abstract actors*
 - `actHuman`: represent abstractly any kind of human being actor wanting to communicate with the ABC system in the context of a car crash.
 - `actAuthenticated`: for the logical Activator stakeholder.

2.3 Use Cases Model

This section contains the use cases elicited during the requirements elicitation phase. The use cases are textually described as suggested by the **Messir** method and inspired by the standard Cokburn template [?].

2.3.1 Use Cases

2.3.1.1 summary-suDeployAndRun

The goal is to install the iCrash system on its infrastructure and to exploit its capacities related to the secure administration and efficient handling of car crash situations depending on alerts received.

¹The naming conventions in **Messir** propose to start each type name by lowercase letters indicating the meta model type used (i.e. act for actors, ct for class type,). In addition to ease the reading it makes the translational semantics into Prolog code more straightforward.

| USE-CASE DESCRIPTION | |
|--|--|
| <i>Name</i> | suDeployAndRun |
| <i>Scope</i> | system |
| <i>Level</i> | summary |
| Primary actor(s) | |
| 1 | actAdministrator [active] |
| Secondary actor(s) | |
| 1 | actMsrCreator [active] |
| 2 | actCoordinator [active, multiple] |
| 3 | actActivator [proactive] |
| 4 | actComCompany [active] |
| Goal(s) description | |
| The goal is to install the iCrash system on its infrastructure and to exploit its capacities related to the secure administration and efficient handling of car crash situations depending on alerts received. | |
| Reuse | |
| 1 | <u>oeCreateSystemAndEnvironment [1..1]</u> |
| 2 | <u>ugAdministrateTheSystem [1..*]</u> |
| 3 | <u>suGlobalCrisisHandling [1..*]</u> |
| 4 | <u>oeSetClock [1..*]</u> |
| 5 | <u>oeSollicitateCrisisHandling [0..*]</u> |
| 6 | <u>oeAlert [1..*]</u> |
| Protocol condition(s) | |
| 1 | the iCrash system has never been deployed and used |
| Pre-condition(s) | |
| 1 | none |
| Main post-condition(s) | |
| 1 | the iCrash system has been created and has handled the crisis situations for which it received alerts through the communication company. |
| Main Steps | |
| a | the actor actMsrCreator executes the <u>oeCreateSystemAndEnvironment</u> use case |
| b | the actor actAdministrator executes the <u>ugAdministrateTheSystem</u> use case |
| c | the actor actComCompany executes the <u>oeAlert</u> use case |
| d | the actor actActivator executes the <u>oeSetClock</u> use case |
| e | the actor actActivator executes the <u>oeSollicitateCrisisHandling</u> use case |
| f | the actor actCoordinator executes the <u>suGlobalCrisisHandling</u> use case |
| Steps Ordering Constraints | |
| 1 | step (a) must be always the first step. |
| 2 | step (f) can be executed by different actCoordinator actors. |
| 3 | if (e) then previously (d). |

Figure 2.1 shows the use case diagram for the suDeployAndRun summary use case

2.3.1.2 summary-suGlobalCrisisHandling

the actCoordinator's goal is to monitor the alerts received and the corresponding crisis in order to act as necessary to handle the crisis.

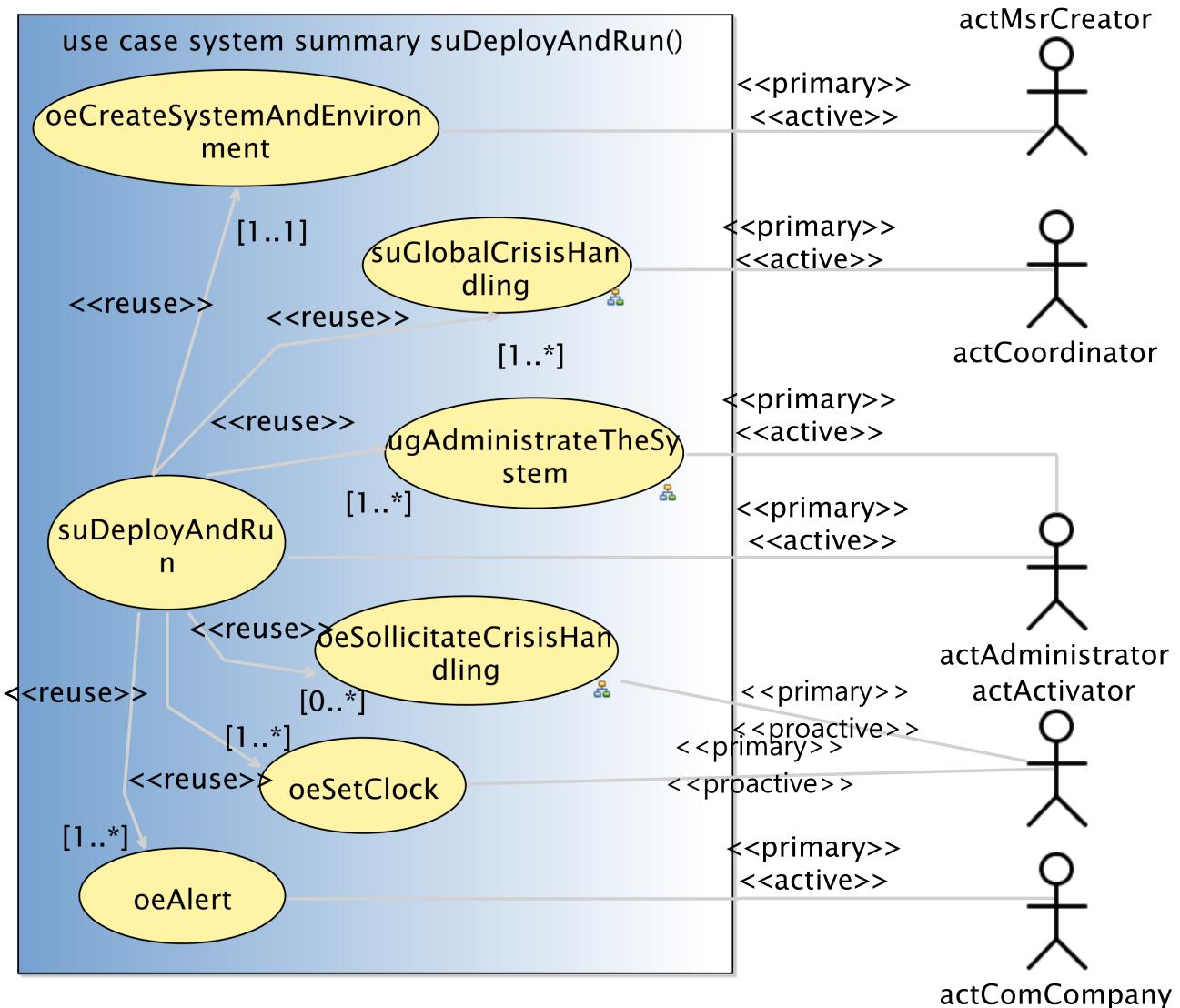


Figure 2.1: suDeployAndRun summary use case

| USE-CASE DESCRIPTION | |
|---|---|
| <i>Name</i> | suGlobalCrisisHandling |
| <i>Scope</i> | system |
| <i>Level</i> | summary |
| Primary actor(s) | |
| 1 | actCoordinator [active] |
| Goal(s) description | |
| the actCoordinator's goal is to monitor the alerts received and the corresponding crisis in order to act as necessary to handle the crisis. | |
| Reuse | |
| 1 | ugSecurelyUseSystem [1..*] |
| 2 | ugMonitor [1..*] |
| 3 | ugManageCrisis [1..*] |
| Protocol condition(s) | |
| 1 | the iCrash system has been deployed |
| 2 | the coordinator actor involved in the use case has been declared by the actor actAdministrator |
| Pre-condition(s) | |
| 1 | none |
| Main post-condition(s) | |
| 1 | modifications have been made by the coordinator on existing alerts or crisis OR the coordinator requested an updated status on existing alerts or crisis. |
| Main Steps | |
| a | the actor actCoordinator executes the ugSecurelyUseSystem use case |
| b | the actor actCoordinator executes the ugMonitor use case |
| c | the actor actCoordinator executes the ugManageCrisis use case |
| Steps Ordering Constraints | |
| 1 | steps (a) (b) and (c) executions are interleaved (steps (b) and (c) have their protocol constrained by steps of (a)). |
| 2 | steps (a) (b) and (c) can be executed multiple times. |

Figure 2.2 shows the use case diagram for the suGlobalCrisisHandling user goal use case

2.3.1.3 usergoal-ugAdministateTheSystem

the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.

| USE-CASE DESCRIPTION | |
|--|---------------------------|
| <i>Name</i> | ugAdministateTheSystem |
| <i>Scope</i> | system |
| <i>Level</i> | usergoal |
| Primary actor(s) | |
| 1 | actAdministrator [active] |
| Goal(s) description | |
| the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis. | |

continues in next page ...

... Use-Case Description table continuation

| |
|--|
| Reuse |
| 1 <u>ugSecurelyUseSystem [1..*]</u> |
| 2 <u>oeAddCoordinator [1..*]</u> |
| 3 <u>oeDeleteCoordinator [0..*]</u> |
| 4 <u>oeEditCoordinator [0..*]</u> |
| Protocol condition(s) |
| 1 the iCrash system has been deployed |
| Pre-condition(s) |
| 1 none |
| Main post-condition(s) |
| 1 modifications have been made to the system and its environment concerning existing or new coordinators. |
| Main Steps |
| a the actor <code>actAdministrator</code> executes the <u>ugSecurelyUseSystem</u> use case |
| b the actor <code>actAdministrator</code> executes the <u>oeAddCoordinator</u> use case |
| c the actor <code>actAdministrator</code> executes the <u>oeDeleteCoordinator</u> use case |
| d the actor <code>actAdministrator</code> executes the <u>oeEditCoordinator</u> use case |
| Steps Ordering Constraints |
| 1 steps (a) (b) (c) and (d) executions are interleaved (steps (b) and (c) have their protocol constrained by steps of (a)). |
| 2 steps (a) (b) (c) and (d) can be executed multiple times. |

Figure 2.3 shows the use case diagram for the ugAdministrateTheSystem user goal use case

2.3.1.4 usergoal-ugManageCrisis

The goal is to do an action that makes the handling of a crisis or an alert progress.

| USE-CASE DESCRIPTION | |
|---|-------------------------------------|
| Name | ugManageCrisis |
| Scope | system |
| Level | usergoal |
| Primary actor(s) | |
| 1 | actCoordinator[active] |
| Goal(s) description | |
| The goal is to do an action that makes the handling of a crisis or an alert progress. | |
| Reuse | |
| 1 | <u>oeValidateAlert [0..*]</u> |
| 2 | <u>oeSetCrisisStatus [0..*]</u> |
| 3 | <u>oeSetCrisisHandler [0..*]</u> |
| 4 | <u>oeReportOnCrisis [0..*]</u> |
| 5 | <u>oeCloseCrisis [0..*]</u> |
| 6 | <u>oeInvalidateAlert [0..*]</u> |
| 7 | <u>oeSetCrisisType [0..*]</u> |
| Protocol condition(s) | |
| 1 | the iCrash system has been deployed |

continues in next page ...

... Use-Case Description table continuation

| | |
|-----------------------------------|---|
| <i>Pre-condition(s)</i> | |
| 1 | none |
| <i>Main post-condition(s)</i> | |
| 1 | there exist one alert or one crisis whose related information has been changed. |
| <i>Main Steps</i> | |
| a | the actor actCoordinator executes the <u>oeValidateAlert</u> use case |
| b | the actor actCoordinator executes the <u>oeSetCrisisStatus</u> use case |
| c | the actor actCoordinator executes the <u>oeSetCrisisHandler</u> use case |
| d | the actor actCoordinator executes the <u>oeReportOnCrisis</u> use case |
| e | the actor actCoordinator executes the <u>oeCloseCrisis</u> use case |
| f | the actor actCoordinator executes the <u>oeInvalidateAlert</u> use case |
| g | the actor actCoordinator executes the <u>oeSetCrisisType</u> use case |
| <i>Steps Ordering Constraints</i> | |
| 1 | managing a crisis is doing one of the indicated use cases. |

Figure 2.4 shows the use case diagram for the ugManageCrisis user goal use case

2.3.1.5 usergoal-ugMonitor

the actCoordinator's goal is to get the detailed list of existing crisis or alerts to decide on next actions to undertake.

| USE-CASE DESCRIPTION | |
|--|--|
| Name | ugMonitor |
| Scope | system |
| Level | usergoal |
| <i>Primary actor(s)</i> | |
| 1 | actCoordinator [active] |
| <i>Goal(s) description</i> | |
| the actCoordinator's goal is to get the detailed list of existing crisis or alerts to decide on next actions to undertake. | |
| <i>Reuse</i> | |
| 1 | <u>oeGetCrisisSet</u> [0..*] |
| 2 | <u>oeGetAlertsSet</u> [0..*] |
| <i>Protocol condition(s)</i> | |
| 1 | the iCrash system has been deployed |
| <i>Pre-condition(s)</i> | |
| 1 | none |
| <i>Main post-condition(s)</i> | |
| 1 | none |
| <i>Main Steps</i> | |
| a | the actor actCoordinator executes the <u>oeGetAlertsSet</u> use case |
| b | the actor actCoordinator executes the <u>oeGetCrisisSet</u> use case |

Figure 2.5 shows the use case diagram for the ugMonitor user goal use case

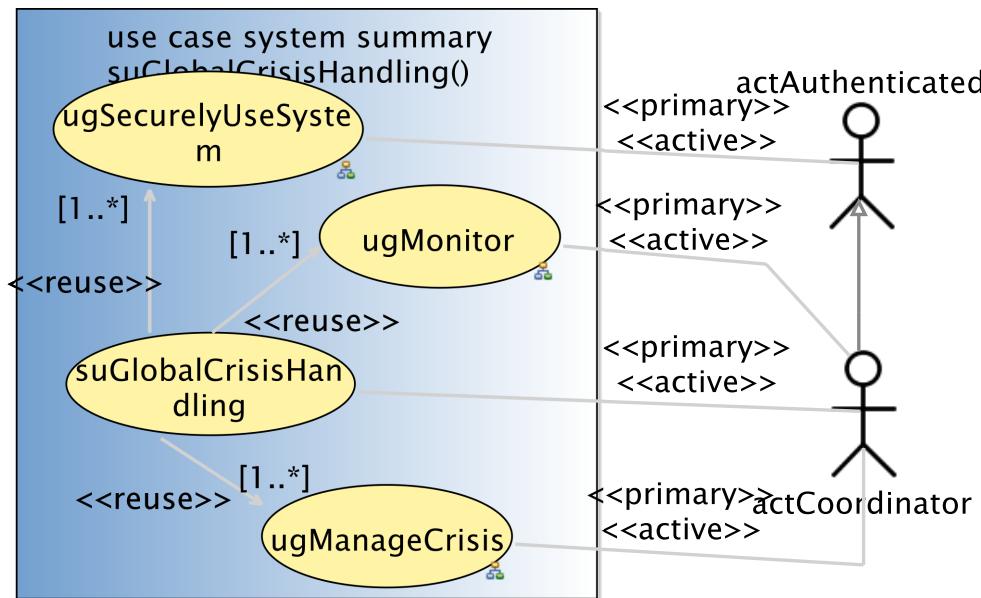


Figure 2.2: suGlobalCrisisHandling user goal use case

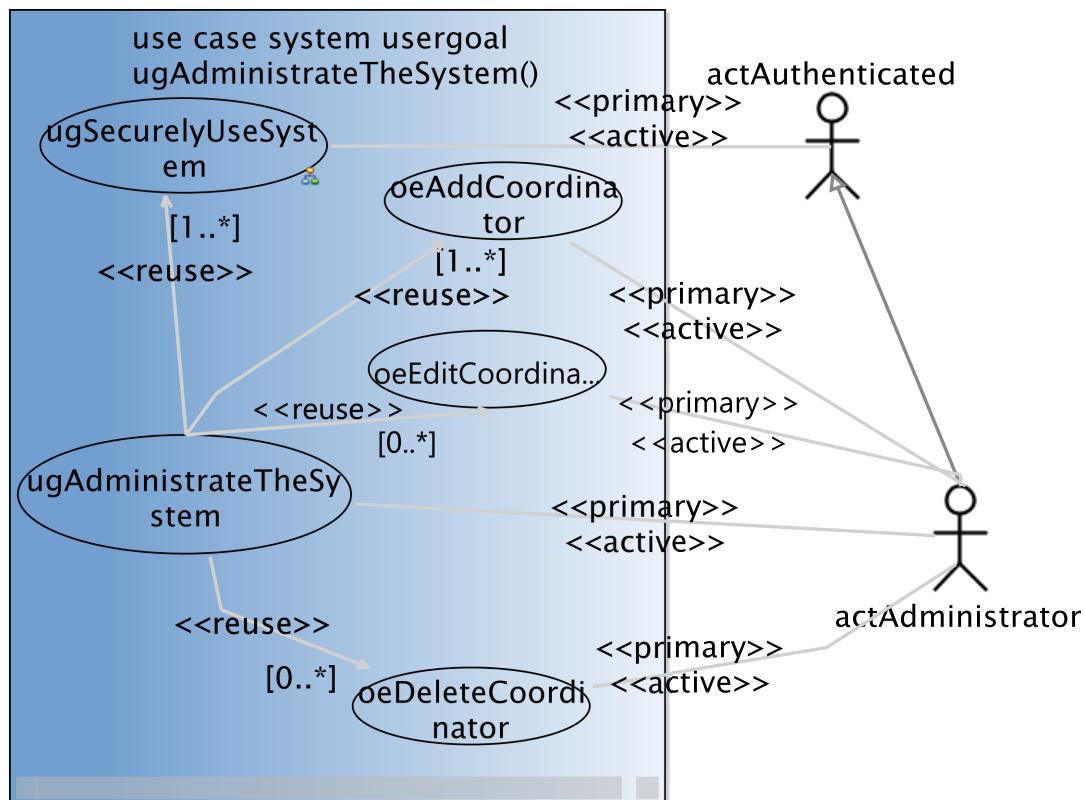


Figure 2.3: ugAdministateTheSystem user goal use case

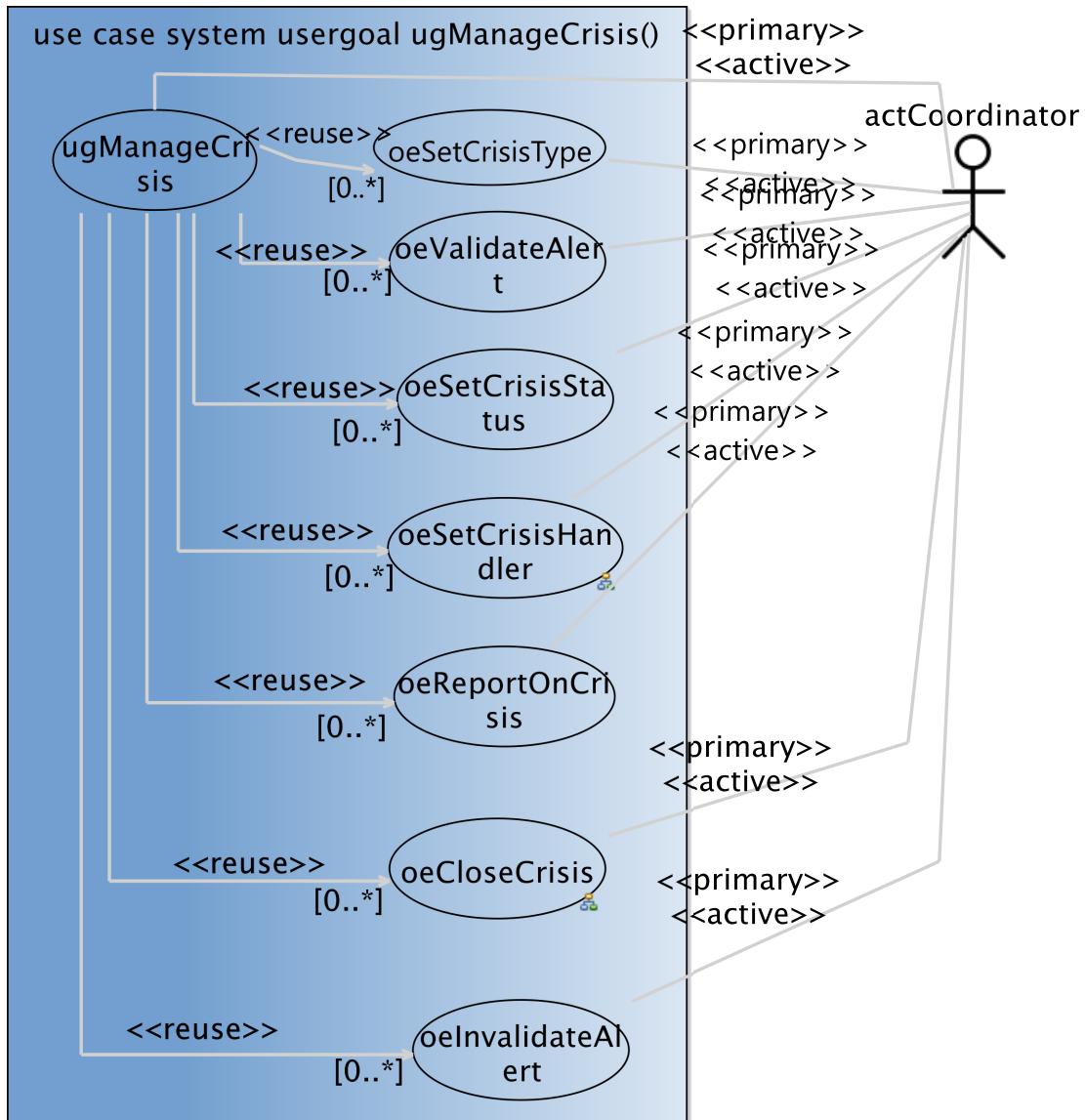


Figure 2.4: ugManageCrisis user goal use case

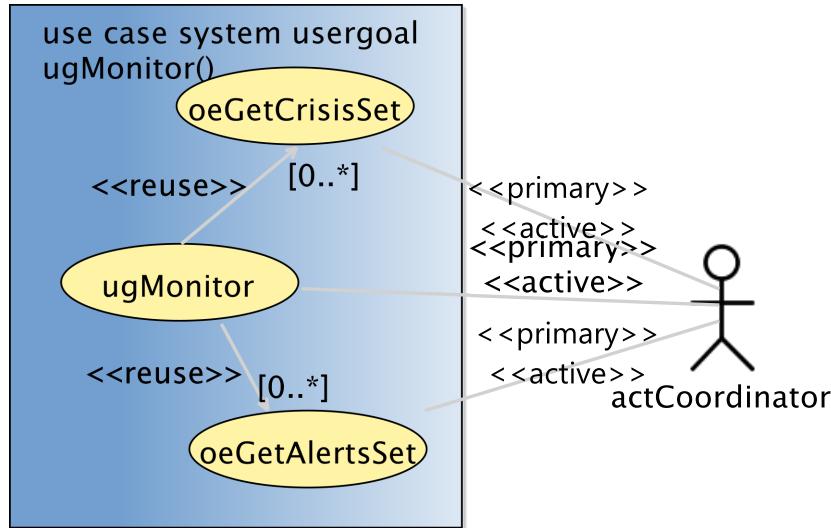


Figure 2.5: ugMonitor user goal use case

2.3.1.6 usergoal-ugSecurelyUseSystem

the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.

| USE-CASE DESCRIPTION | |
|--|--|
| Name | ugSecurelyUseSystem |
| Scope | system |
| Level | usergoal |
| <i>Primary actor(s)</i> | |
| 1 | actAuthenticated [active] |
| <i>Goal(s) description</i> | |
| the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis. | |
| <i>Reuse</i> | |
| 1 | <u>oeLogin</u> [1..1] |
| 2 | <u>oeLogout</u> [1..1] |
| 3 | <u>oeSMS</u> [1..1] |
| <i>Protocol condition(s)</i> | |
| 1 | the iCrash system has been deployed |
| <i>Pre-condition(s)</i> | |
| 1 | none |
| <i>Main post-condition(s)</i> | |
| 1 | the actAuthenticated is known by the system not to be logged. |
| <i>Main Steps</i> | |
| a | the actor actAuthenticated executes the <u>oeLogin</u> use case |
| b | the actor actAuthenticated executes the <u>oeLogout</u> use case |
| c | the actor actAuthenticated executes the <u>oeSMS</u> use case |
| <i>Steps Ordering Constraints</i> | |

continues in next page ...

... Use-Case Description table continuation

| | |
|---|--|
| 1 | step (a) must always precede step (c). step (c) must always precede step(b). |
|---|--|

Figure 2.6 shows the use case diagram for the ugSecurelyUseSystem user goal use case

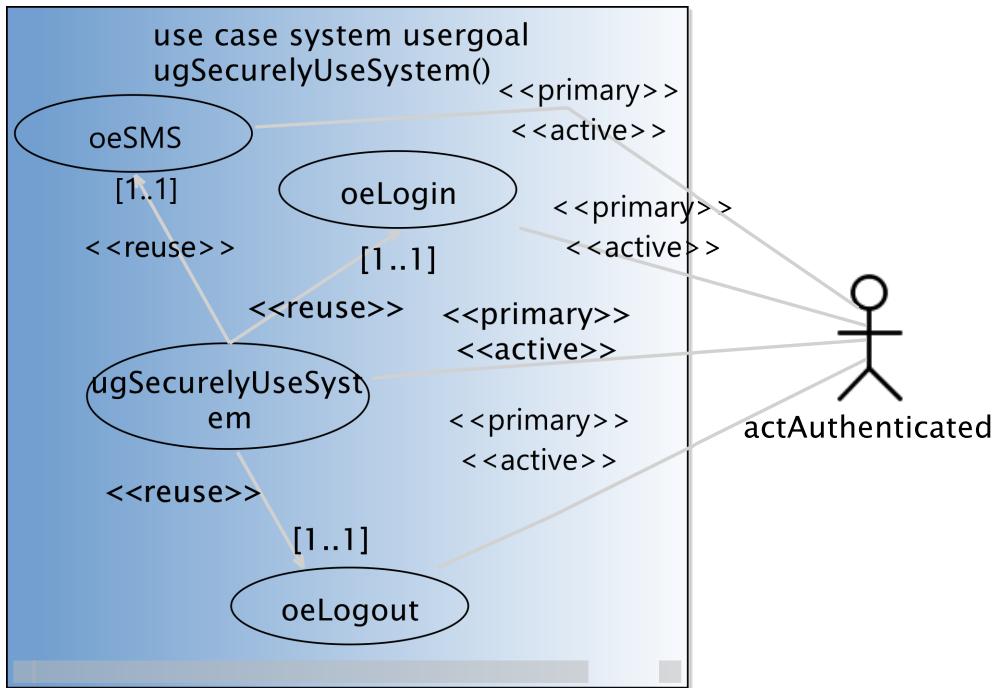


Figure 2.6: ugSecurelyUseSystem user goal use case

2.3.1.7 subfunction-oeSetCrisisHandler

goal is to declare himself as been the handler of a crisis having the specified id.

| USE-CASE DESCRIPTION | |
|---|----------------------------------|
| Name | oeSetCrisisHandler |
| Scope | system |
| Level | subfunction |
| Parameters | |
| AdtCrisisID: | dtCrisisID 1 |
| Primary actor(s) | |
| 1 | actCoordinator[active] |
| Secondary actor(s) | |
| 1 | actCoordinator[passive] |
| 2 | actComCompany[passive, multiple] |
| Goal(s) description | |
| goal is to declare himself as been the handler of a crisis having the specified id. | |
| Protocol condition(s) | |

continues in next page ...

... Use-Case Description table continuation

| |
|-------------------------------|
| 1 |
| <i>Pre-condition(s)</i> |
| 1 |
| <i>Main post-condition(s)</i> |
| 1 |
| <i>Additional Information</i> |
| none |

Figure 2.7 shows the use case diagram for the oeSetCrisisHandler subfunction use case

2.3.1.8 subfunction-oeSollicitateCrisisHandling

the actActivator's goal is to decrease the number of unhandled crisis.

| USE-CASE DESCRIPTION |
|--|
| <i>Name</i> oeSollicitateCrisisHandling |
| <i>Scope</i> system |
| <i>Level</i> subfunction |
| <i>Primary actor(s)</i> |
| 1 actActivator[proactive] |
| <i>Secondary actor(s)</i> |
| 1 actCoordinator[passive, multiple] |
| 2 actAdministrator[passive] |
| <i>Goal(s) description</i> |
| the actActivator's goal is to decrease the number of unhandled crisis. |
| <i>Protocol condition(s)</i> |
| 1 the iCrash system has been deployed. |
| 2 there exist some crisis still pending and for which no solicitation has been sent to the administrator and the coordinators for more than a predefined maximum delay. |
| <i>Pre-condition(s)</i> |
| 1 none |
| <i>Main post-condition(s)</i> |
| 1 a simple text message ieMessage('There are alerts not treated since more than the defined delay. Please REACT !') is sent to the system administrator and to all the coordinators of the environment for each crisis that is known to be not handled and for which no solicitation has been sent to the administrator and the coordinators for more than a predefined maximum delay.' |
| 2 the reminder period for the concerned crisis is initialized. |

Figure 2.8 shows the use case diagram for the oeSollicitateCrisisHandling subfunction use case

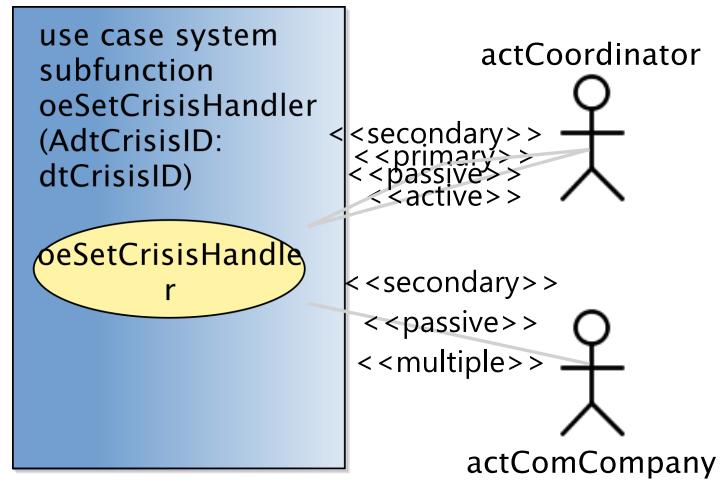


Figure 2.7: oeSetCrisisHandler subfunction use case

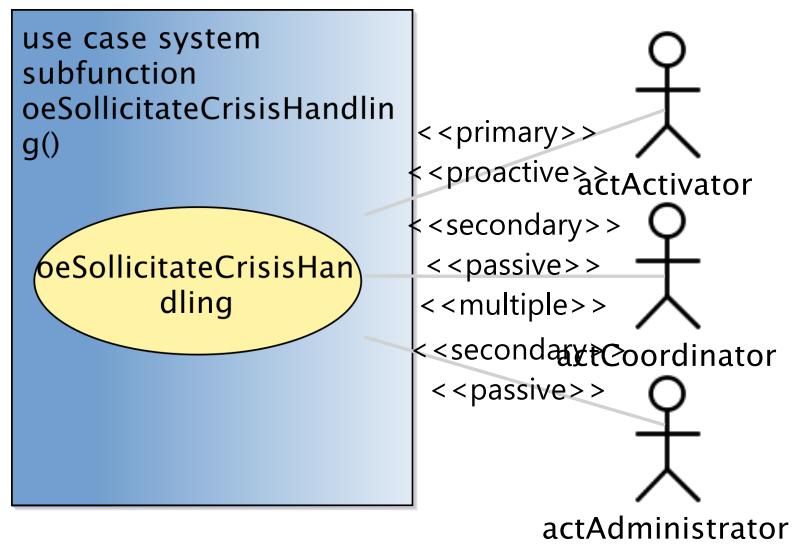


Figure 2.8: oeSollicitateCrisisHandling subfunction use case

2.3.2 Use Case Instance(s)

2.3.2.1 Use-Case Instance - uciSimpleAndCompletePart01:suDeployAndRun

First part of a use case instance for the summary use case `suDeployAndRun` illustrating a simple and complete interaction scenario primarily handled by an administrator in a concrete situation.

| SUMMARY USE-CASE INSTANCE | |
|---|--|
| <i>Instantiated Use Case</i> | |
| <code>suDeployAndRun</code> | |
| <i>Instance ID</i> | |
| <code>uciSimpleAndCompletePart01</code> | |
| <i>Remarks</i> | |
| a | shows the system initialization and the first administrative tasks by the administrator. |
| b | The unique and always existing <code>actMsrCreator</code> actor instance (named here <code>theCreator</code>) requests the initialization of the system and its environment (made of one administrator identified here by <code>bill</code>), one activator actor (identified by <code>theClock</code>) and indicating that the number of communication company actor instances for the system's environment is 4 (one of them is identified here by <code>tango</code>) |
| c | the administrator logs in to initialize a coordinator |
| d | an alert is received. Time is going on without having the coordinator handling the alert which let's the proactive actor trigger the automatic solicitation of crisis handling. |
| e | this first part stops before the coordinator logs in the system. |

Figure 2.9 shows the sequence diagram representing the first part of a simple and complete use case instance for the summary use case `suDeployAndRun`.

2.3.2.2 Use-Case Instance - uciSimpleAndCompletePart02:suDeployAndRun

Second part of a simple and complete use case instance for the summary use case `suDeployAndRun` illustrating a simple and complete interaction scenario primarily handled by an administrator in a concrete situation.

| SUMMARY USE-CASE INSTANCE | |
|---|--|
| <i>Instantiated Use Case</i> | |
| <code>suDeployAndRun</code> | |
| <i>Instance ID</i> | |
| <code>uciSimpleAndCompletePart02</code> | |
| <i>Remarks</i> | |
| a | starts when the coordinator logs in the system until the full handling of all the existing crisis. |
| b | shows an instantiated case of handling of a crisis by a coordinator until its closure after reporting. |

Figure 2.10 shows the sequence diagram representing the second part of a simple and complete use case instance for the summary use case `suDeployAndRun`.

2.3.2.3 Use-Case Instance - uciSimpleAndCompletePart03:suDeployAndRun

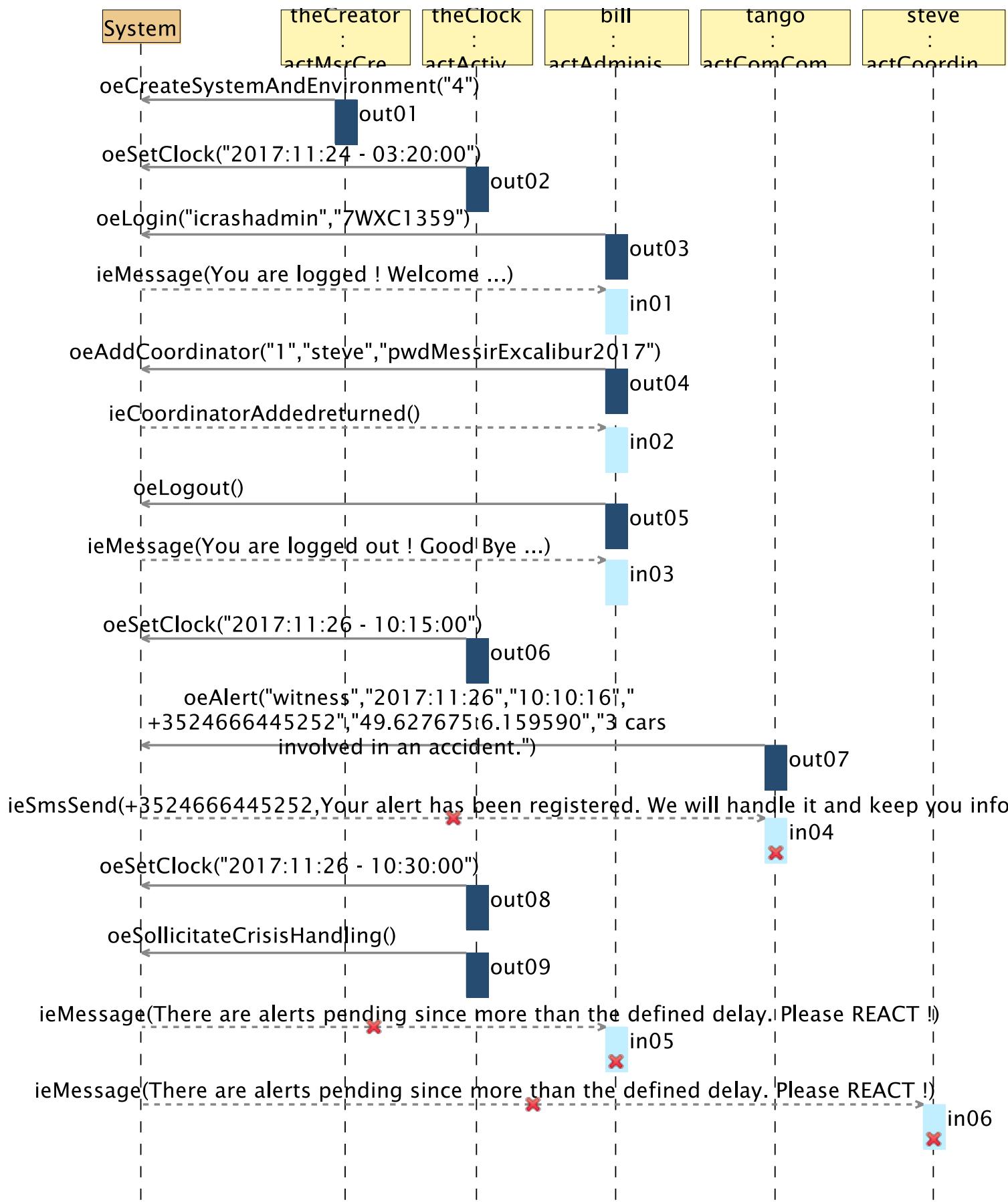


Figure 2.9: uci-suDeployAndRun-uciSimpleAndComplete-Part01

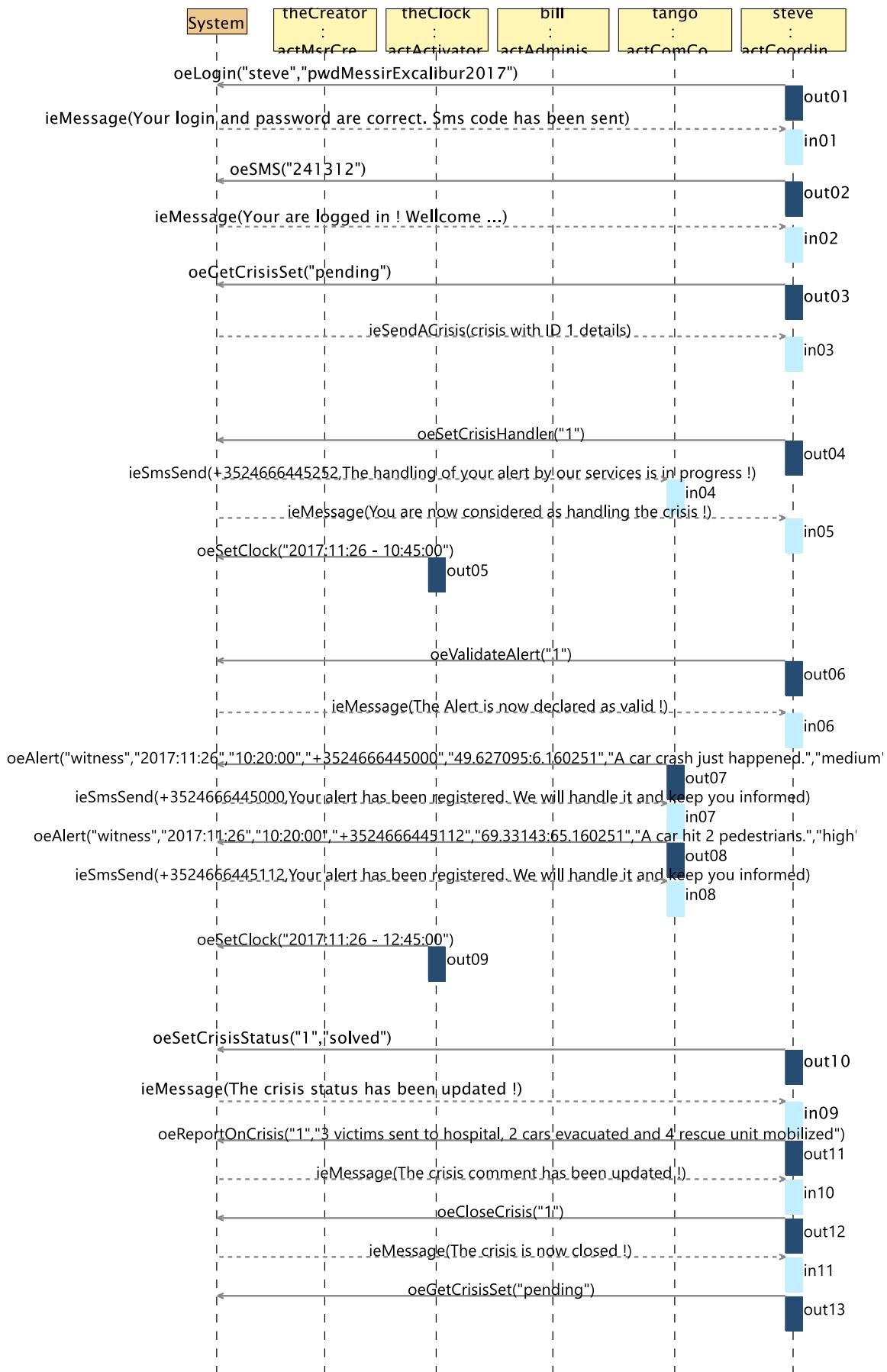


Figure 2.10: uci-suDeployAndRun-uciSimpleAndComplete-Part02 use case instance sequence diagram

| SUMMARY USE-CASE INSTANCE |
|--|
| <i>Instantiated Use Case</i> suDeployAndRun |
| <i>Instance ID</i> uciSimpleAndCompletePart03 |

2.3.2.4 Use-Case Instance - uciugSecurelyUseSystem:ugSecurelyUseSystem

| USERGOAL USE-CASE INSTANCE |
|---|
| <i>Instantiated Use Case</i> ugSecurelyUseSystem |
| <i>Instance ID</i> uciugSecurelyUseSystem |

Figure 2.11



Figure 2.11:

Chapter 3

Environment Model

We provide below the view(s) defined for the **Messip** environment model (cf. [?]) of the system.

3.1 Local view 01

Figure 3.1 shows the local view giving the second part of the environment model of the system in term of its state class, actors with their input and output interfaces and all related associations.

3.2 Local view 02

Figure 3.2 shows the local view giving the second part the environment model of the system in term of its state class, actors with their input and output interfaces and all related associations.

3.3 Local view 03

Figure 3.3 shows the local view for the administrator actor and interfaces

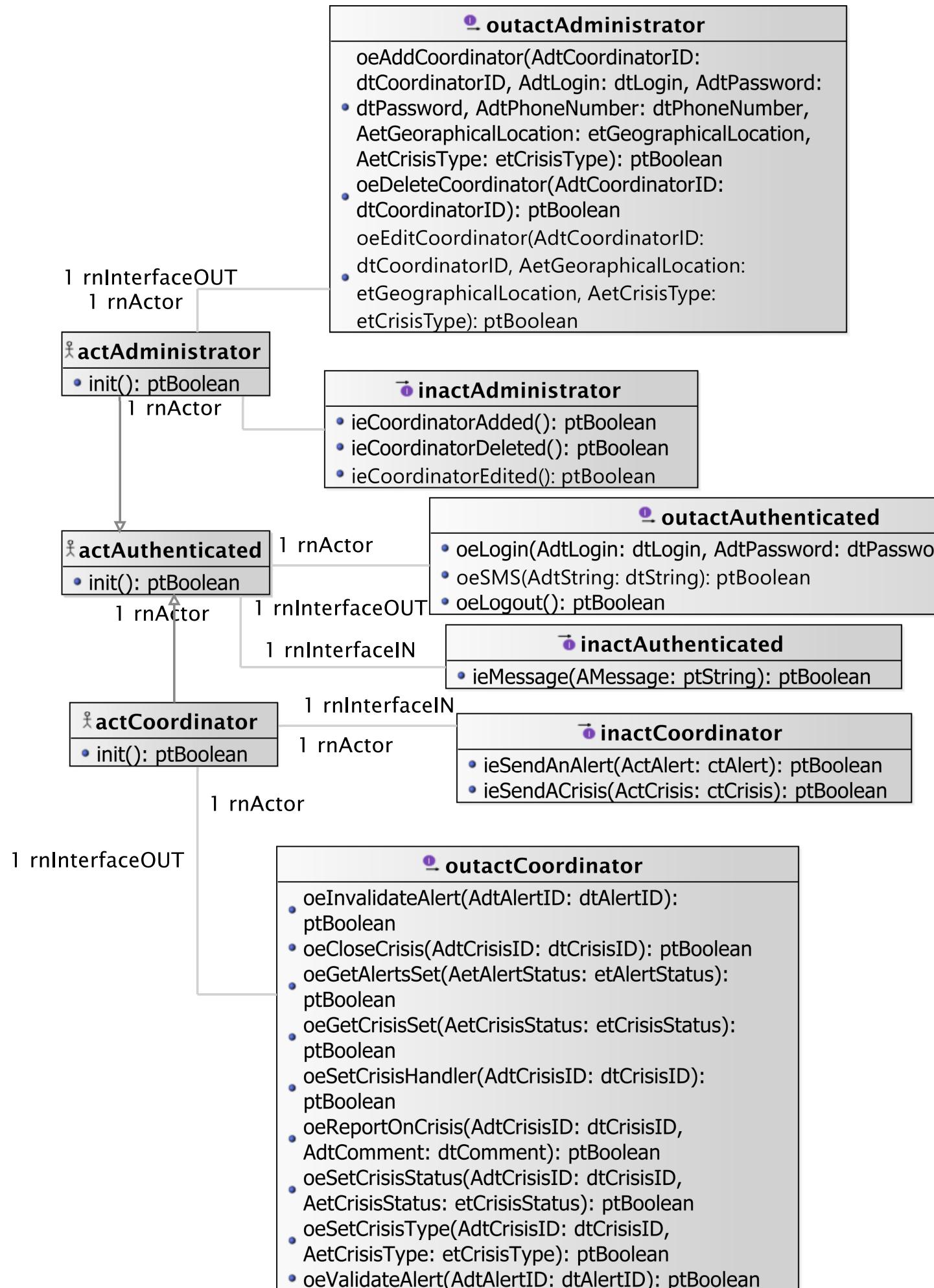
3.4 Local view 04

Figure 3.4 shows the local view for the coordinator actor and interfaces

3.5 Local view 05

Figure 3.5 shows the local view for the authenticated actor and interfaces

3.6 Global view 01



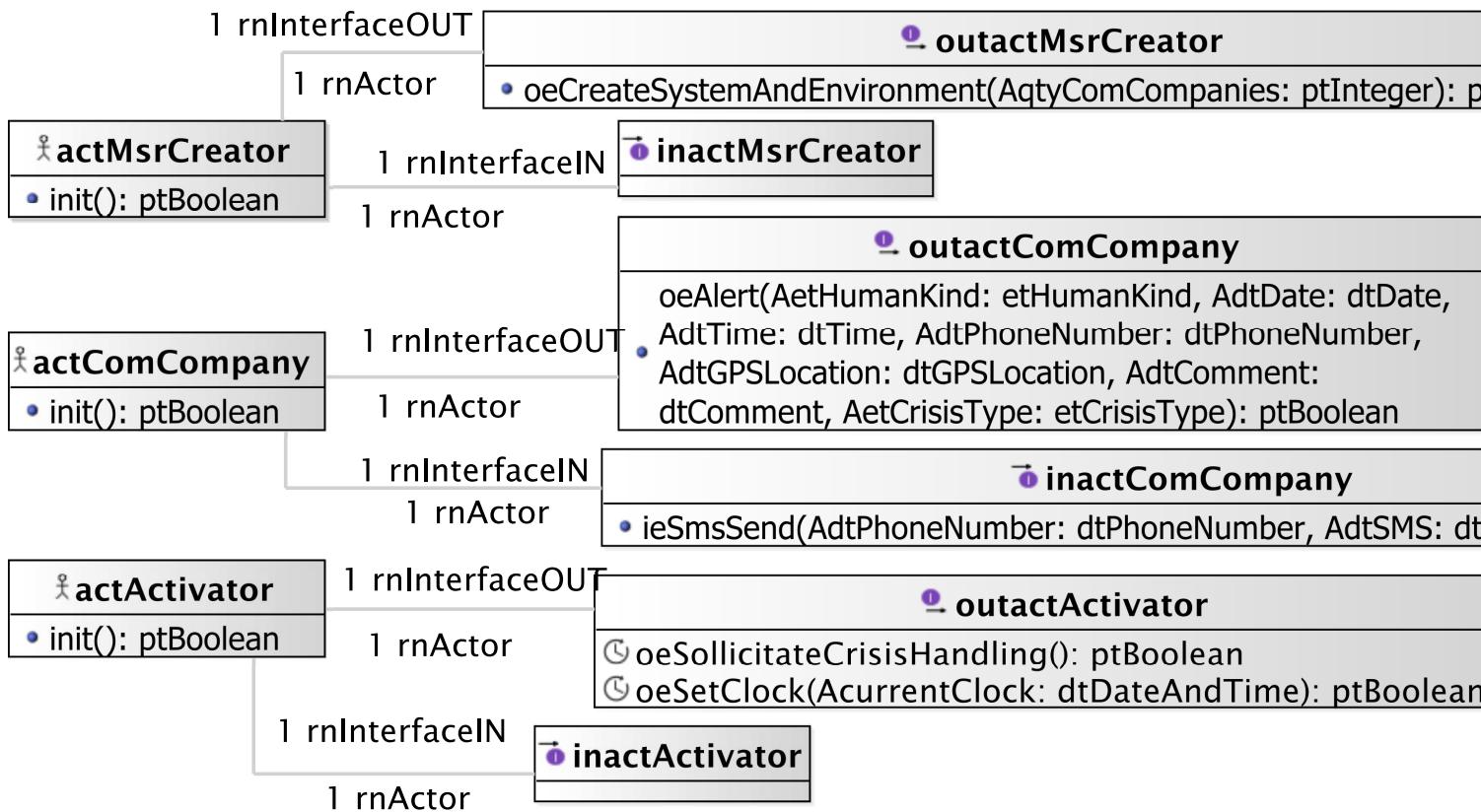


Figure 3.2: Environment Model - Local View 02. environment model local view - Part 2.

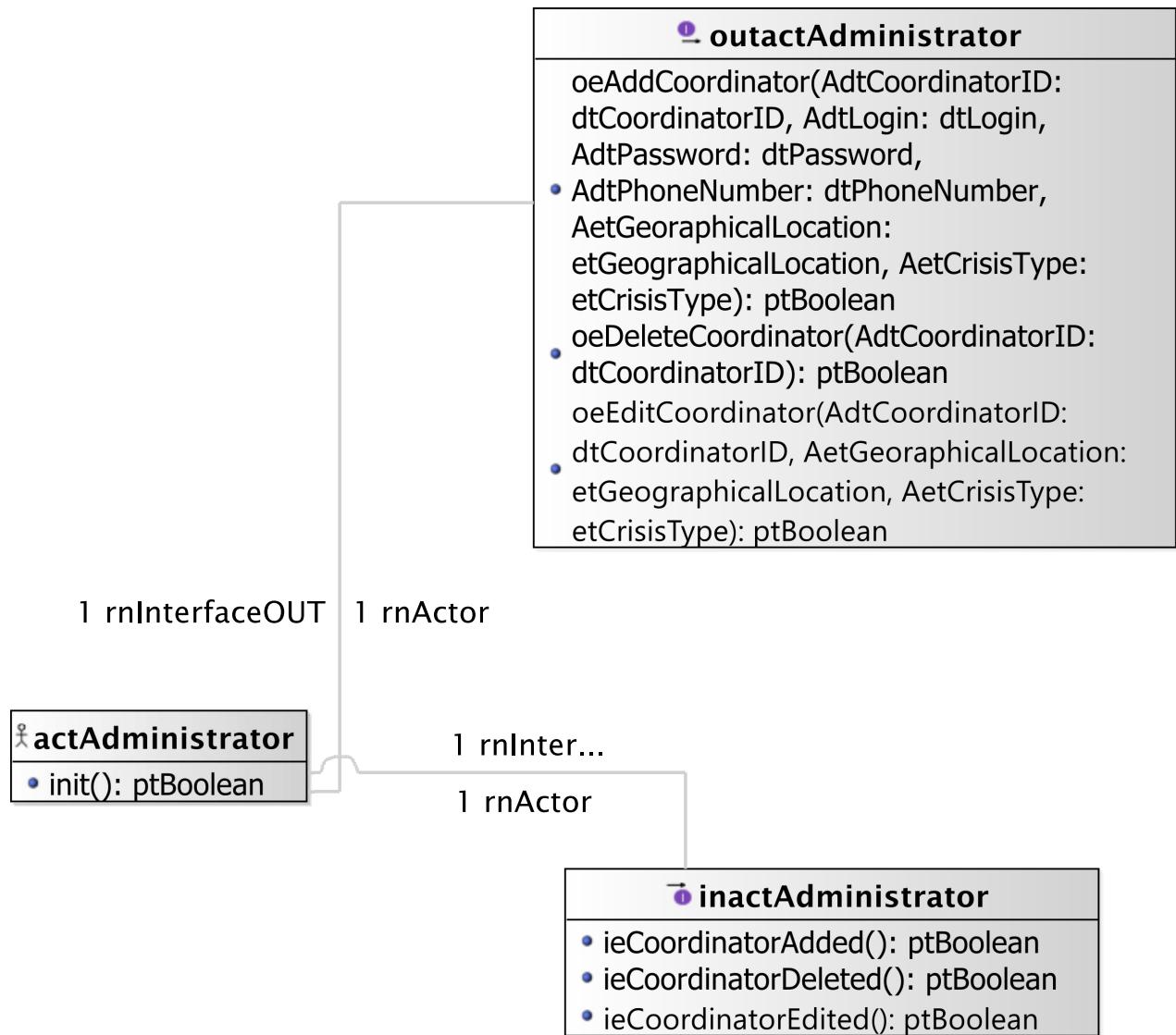


Figure 3.3: Environment Model - Local View 03. administrator actor environment model view.

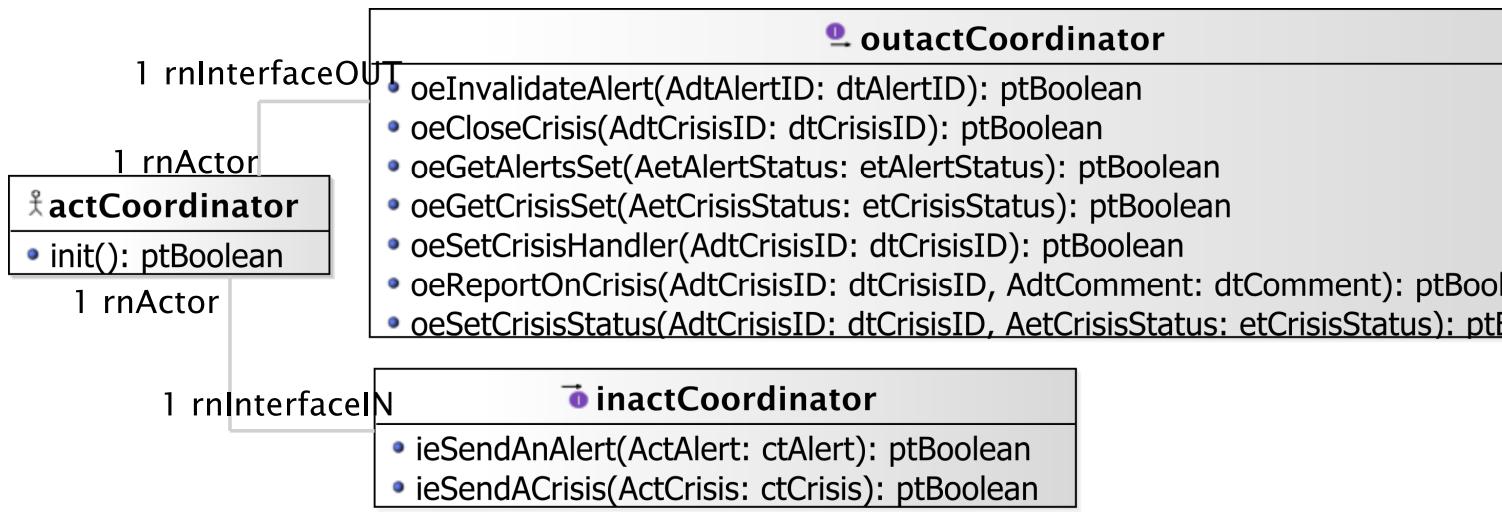


Figure 3.4: Environment Model - Local View 04. coordinator actor environment model view.

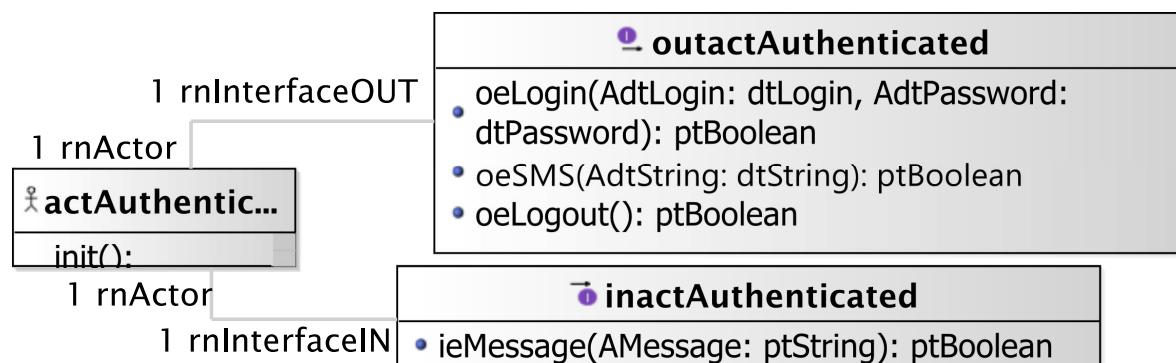


Figure 3.5: Environment Model - Local View 05. authenticated actor environment model local view.

Figure 3.6 shows a global view for all actors with their relationships with ctState

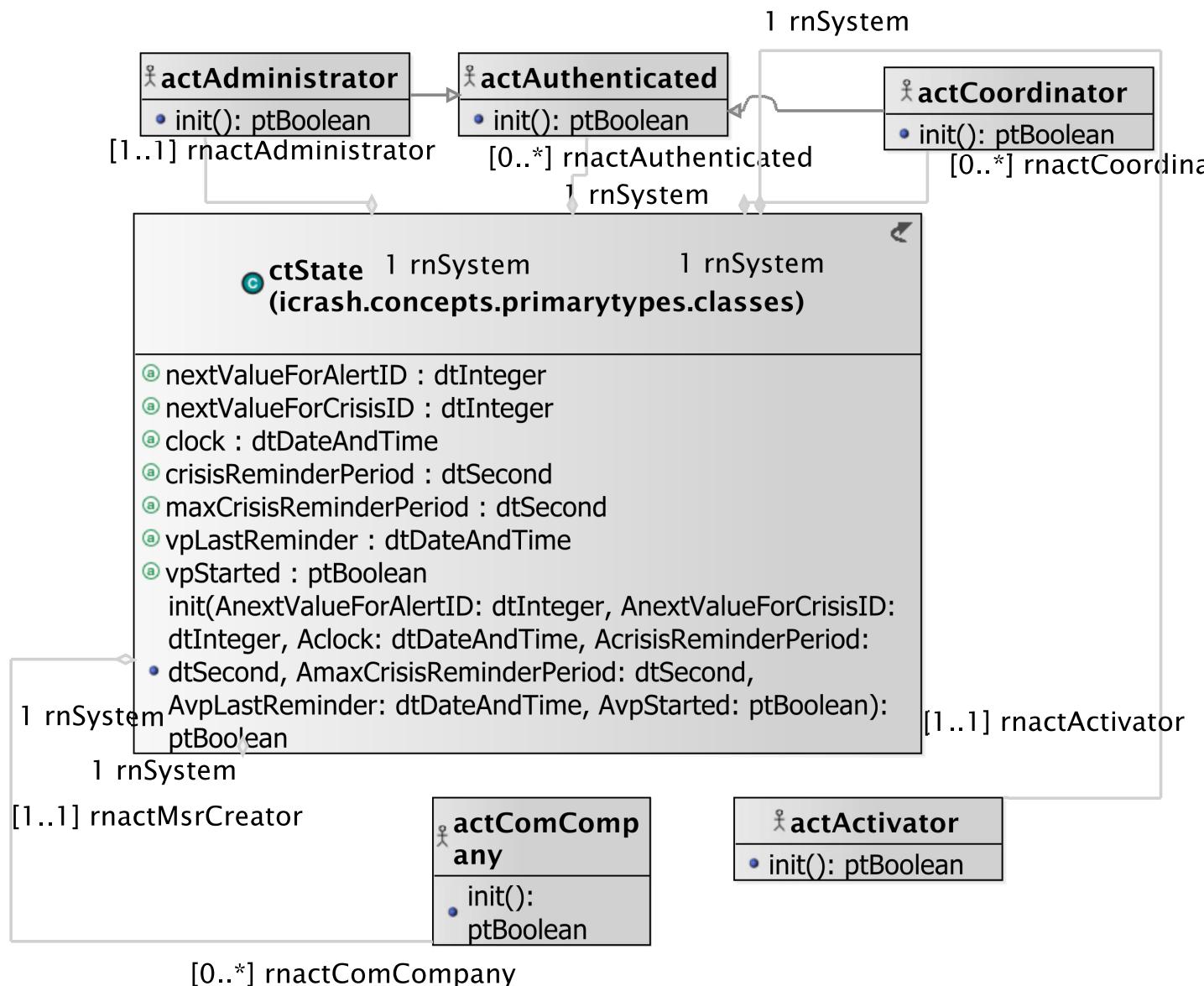


Figure 3.6: Environment Model - Global View 01. em-gv-01 environment model global view.

3.7 Actors and Interfaces Descriptions

We provide for the given views the description of the actors together with their associated input and output interface descriptions.

3.7.1 **actActivator** Actor

| ACTOR | |
|--|--|
| <i>actActivator</i> | |
| represents a logical actor for time automatic message sending based on system's or environment status. | |
| <i>OutputInterfaces</i> | |
| OUT 1 | [proactive] oeSollicitateCrisisHandling() :ptBoolean used to avoid crisis to stay too long in an not handled status. |
| OUT 2 | [proactive] oeSetClock(AcurrentClock:dtDateAndTime) :ptBoolean used to update the system's time |

3.7.2 actAdministrator Actor

| ACTOR | |
|---|--|
| <i>actAdministrator</i> | |
| represents an actor responsible of administration tasks for the <i>iCrash</i> system. | |
| <i>Extends</i> | |
| icrash.environment.actAuthenticated | |
| <i>OutputInterfaces</i> | |
| OUT 1 | oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID, AdtLogin:dtLogin, AdtPassword:dtPassword, AdtPhoneNumber:dtPhoneNumber, AetGeographicalLocation:etGeographicalLocation, AetCrisisType:etCrisisType) :ptBoolean sent to add a new coordinator in the system's post state and environment's post state. |
| OUT 2 | oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID) :ptBoolean sent to delete an existing coordinator in the system's post state and environment's post state. |
| OUT 3 | oeEditCoordinator(AdtCoordinatorID:dtCoordinatorID, AetGeographicalLocation:etGeographicalLocation, AetCrisisType:etCrisisType) :ptBoolean sent to edit an existing coordinator in the system's post state and environment's post state. |
| <i>InputInterfaces</i> | |
| IN 1 | ieCoordinatorAdded() :ptBoolean its reception confirms the creation of the requested coordinator. |
| IN 2 | ieCoordinatorDeleted() :ptBoolean its reception confirms the deletion of the requested coordinator. |
| IN 3 | ieCoordinatorEdited() :ptBoolean its reception confirms the edition of the requested coordinator. |

3.7.3 actAuthenticated Actor

| ACTOR | |
|--|---|
| <i>actAuthenticated</i> | |
| abstract actor providing reusable input and output interfaces for actors that need to authenticate themselves. | |
| <i>OutputInterfaces</i> | |
| OUT 1 | oeLogin(AdtLogin:dtLogin, AdtPassword:dtPassword) :ptBoolean sent to request authorization to request access secured system operations. |
| OUT 2 | oeLogout() :ptBoolean |

continues in next page ...

...Actor table continuation

| | |
|------------------------|--|
| | sent to end the secured access to specific system operations. |
| OUT 3 | oeSMS (AdtString:dtString) :ptBoolean sent to request authorization to request access secured system operations. |
| <i>InputInterfaces</i> | |
| IN 1 | ieMessage (AMessage:ptString) :ptBoolean allows for receiving general textual messages. |

3.7.4 actComCompany Actor

| ACTOR |
|--|
| <i>actComCompany</i> |
| represents the communication company stakeholder ensuring the input/ouput of textual messages with humans having communicaiton devices. |
| <i>OutputInterfaces</i> |
| OUT 1 oeAlert (AetHumanKind:etHumanKind, AdtDate:dtDate, AdtTime:dtTime, AdtPhoneNumber:dtPhoneNumber, AdtGPSLocation:dtGPSLocation, AdtComment:dtComment, AetCrisisType:etCrisisType) :ptBoolean sent to alert of a potential crisis situation. |
| <i>InputInterfaces</i> |
| IN 1 ieSmsSend (AdtPhoneNumber:dtPhoneNumber, AdtSMS:dtSMS) :ptBoolean allows for receiving textual messages to be dispatched to the communication company customers having the provided phone number. |

3.7.5 actCoordinator Actor

| ACTOR |
|--|
| <i>actCoordinator</i> |
| represents actor responsible of handling one or several crisis for the <i>iCrash</i> system. |
| <i>Extends</i> |
| icrash.environment.actAuthenticated |
| <i>OutputInterfaces</i> |
| OUT 1 oeInvalidateAlert (AdtAlertID:dtAlertID) :ptBoolean sent to indicate that an alert should be considered as closed. |
| OUT 2 oeCloseCrisis (AdtCrisisID:dtCrisisID) :ptBoolean sent to indicate that a crisis should be considered as closed. |
| OUT 3 oeGetAlertsSet (AetAlertStatus:etAlertStatus) :ptBoolean sent to request all the ctAlert instances having a specific status. |
| OUT 4 oeGetCrisisSet (AetCrisisStatus:etCrisisStatus) :ptBoolean sent to request all the ctCrisis instances having a specific status. |
| OUT 5 oeSetCrisisHandler (AdtCrisisID:dtCrisisID) :ptBoolean sent to declare himself as been the handler of a crisis having the specified id. |
| OUT 6 oeReportOnCrisis (AdtCrisisID:dtCrisisID, AdtComment:dtComment) :ptBoolean sent to update the textual information available for a specific handled crisis. |
| OUT 7 oeSetCrisisStatus (AdtCrisisID:dtCrisisID, AetCrisisStatus:etCrisisStatus) :ptBoolean sent to define the handling status of a specific crisis. |
| OUT 8 oeSetCrisisType (AdtCrisisID:dtCrisisID, AetCrisisType:etCrisisType) :ptBoolean |

continues in next page ...

...Actor table continuation

sent to define the gravity type of a specific crisis.

OUT 9 oeValidateAlert (AdtAlertID:dtAlertID) :ptBoolean

sent to indicate that a specific alert is not a fake.

InputInterfaces

IN 1 ieSendAnAlert (ActAlert:ctAlert) :ptBoolean

allows for receiving a requested ctAlert instance.

IN 2 ieSendACrisis (ActCrisis:ctCrisis) :ptBoolean

allows for receiving a requested ctCrisis instance.

3.7.6 actMsrCreator Actor

| ACTOR |
|--|
| <i>actMsrCreator</i> |
| Represents the creator stakeholder in charge of state and environment initialization. |
| <i>OutputInterfaces</i> |
| OUT 1 oeCreateSystemAndEnvironment (AqtyComCompanies:ptInteger) :ptBoolean <p>sent to request the initialization of the system's class instances and the environment actors instances.</p> |

Chapter 4

Concept Model

4.1 PrimaryTypes-Classes

4.1.1 Local view 01

Figure 4.1 shows the local view on all the primary types class types.

4.1.2 Local view 02

Figure 4.2 shows the local view of the ctState primary type class type.

4.1.3 Local view 03

Figure 4.3 shows the local view of the ctAlert primary type class type.

4.1.4 Local view 04

Figure 4.4 shows the local view of the ctCrisis primary type class type.

4.1.5 Global view 01

Figure 4.5 shows the global view on primary types class types showing the association(s) types with the actor classes of the environment model.

4.2 PrimaryTypes-Datatypes

4.2.1 Local view 06

Figure 4.6

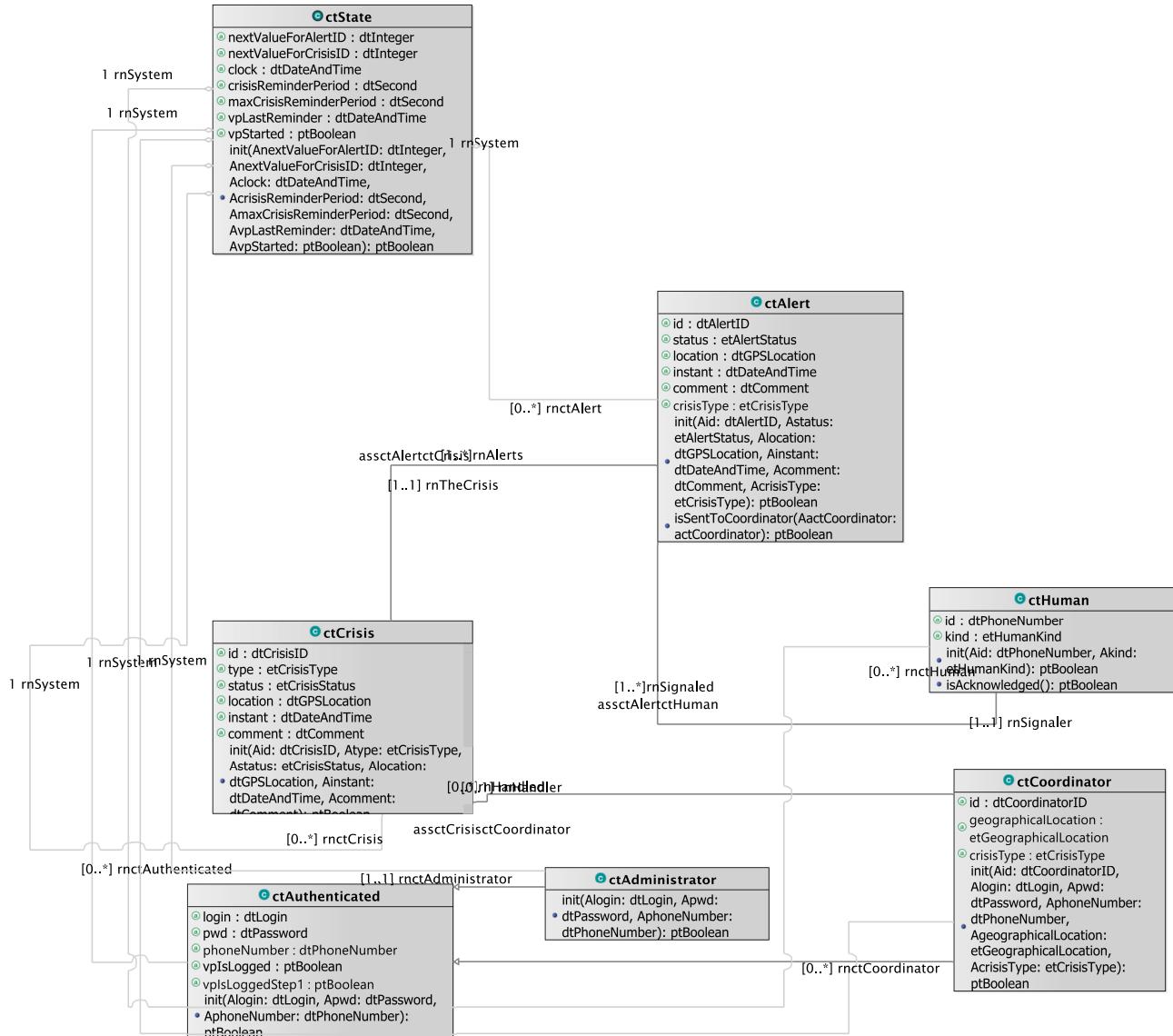


Figure 4.1: Concept Model - PrimaryTypes-Classes local view 01. Local view of all the primary types class types .

| C ctState | |
|------------------|--|
| ④ | nextValueForAlertID : dtInteger |
| ④ | nextValueForCrisisID : dtInteger |
| ④ | clock : dtDateAndTime |
| ④ | crisisReminderPeriod : dtSecond |
| ④ | maxCrisisReminderPeriod : dtSecond |
| ④ | vpLastReminder : dtDateAndTime |
| ④ | vpStarted : ptBoolean |
| | init(AnextValueForAlertID: dtInteger, AnextValueForCrisisID: dtInteger, Aclock: |

Figure 4.2: Concept Model - PrimaryTypes-Classes local view 02. local view of the ctState primary type.

| C ctAlert | |
|------------------|---|
| ④ | id : dtAlertID |
| ④ | status : etAlertStatus |
| ④ | location : dtGPSLocation |
| ④ | instant : dtDateAndTime |
| ④ | comment : dtComment |
| ④ | crisisType : etCrisisType |
| | init(Aid: dtAlertID, Astatus: etAlertStatus, Alocation: dtGPSLocation, Ainstant: dtDateAndTime, Acomment: dtComment, AcrisisType: etCrisisType): ptBoolean |
| | isSentToCoordinator(AactCoordinator: actCoordinator): ptBoolean |

Figure 4.3: Concept Model - PrimaryTypes-Classes local view 03. local view of the ctAlert primary type.

| ctCrisis | |
|---|--|
| • id : dtCrisisID | |
| • type : etCrisisType | |
| • status : etCrisisStatus | |
| • location : dtGPSLocation | |
| • instant : dtDateAndTime | |
| • comment : dtComment | |
| init(Aid: dtCrisisID, Atype: etCrisisType, Astatus: | |
| • etCrisisStatus, Alocation: dtGPSLocation, Ainstant: | |
| dtDateAndTime, Acomment: dtComment): ptBoolean | |
| • handlingDelayPassed(): ptBoolean | |
| • maxHandlingDelayPassed(): ptBoolean | |
| • isSentToCoordinator(AactCoordinator: actCoordinator): | |
| • ptBoolean | |
| • isAllocatedIfPossible(): ptBoolean | |

Figure 4.4: Concept Model - PrimaryTypes-Classes local view 04. local view of the ctCrisis primary type.

4.2.2 Global view 01

Figure 4.7 shows a global view on the *iCrash* primary types datatype types.

4.3 SecondaryTypes-Datatypes

4.3.1 Local view 01

Figure 4.8 shows the local view of the secondary types datatype types.

4.4 Concept Model Types Descriptions

This section provides the textual descriptions of all the types defined in the concept model and that can be part of the graphical views provided.

4.4.1 Primary types - Class types descriptions

The table below is providing comments on the graphical views given for the class types of the primary types. Type logical operations are precisely specified in the operation model.

| CLASSES | |
|--|---|
| <i>ctAdministrator</i> | |
| used to characterize internally the entity that is responsible of administrating the <i>iCrash</i> system. | |
| extends | icrash.concepts.primarytypes.classes.ctAuthenticated |
| operation | init (Alogin:dtLogin, Apwd:dtPassword, AphoneNumber:dtPhoneNumber) : ptBoolean |
| | <i>continues in next page ...</i> |

... Classes table continuation

| | |
|------------------------|---|
| | used to initialize the current object as a new instance of the ctAdministrator type. |
| ctAlert | |
| | Used to model crisis alerts sent by any human having communication capability using communication companies belonging to the system's environment |
| attribute | comment: <code>dtComment</code> a textual description providing unstructured information on the alert. |
| attribute | id: <code>dtAlertID</code> the alert unique identification information. |
| attribute | instant: <code>dtDateAndTime</code> the date and time at which the alert notification has been sent. |
| attribute | location: <code>dtGPSLocation</code> the position of the alert provided by the space-based satellite navigation system used by the human using the communication company to inform the <i>iCrash</i> system of a crisis. |
| attribute | status: <code>etAlertStatus</code> the alert validation status |
| operation | <code>init(Aid:dtAlertID, Astatus:etAlertStatus,</code> <code>Alocation:dtGPSLocation, Ainstant:dtDateAndTime,</code> <code>Acomment:dtComment, AcrisisType:etCrisisType) :ptBoolean</code> used to initialize the current object as a new instance of the ctAlert type. |
| operation | isSentToCoordinator(AactCoordinator:actCoordinator) :ptBoolean used to provide a given coordinator with current alert information. |
| ctAuthenticated | |
| | used to model system's representation about actors that need to authenticate to access some specific functionalities. |
| attribute | login: <code>dtLogin</code> an identifier for authentication. |
| attribute | phoneNumber: <code>dtPhoneNumber</code> use for identifying a user phone number |
| attribute | pwd: <code>dtPassword</code> a key for authentication. |
| attribute | vpIsLogged: <code>ptBoolean</code> used to determine the access status. |
| attribute | vpIsLoggedStep1: <code>ptBoolean</code> used to determine the correctness of password and login. |
| operation | <code>init(Alogin:dtLogin, Apwd:dtPassword, AphoneNumber:dtPhoneNumber) :ptBoolean</code> used to initialize the current object as a new instance of the ctAuthenticated type. |
| ctCoordinator | |
| | used to model system's representation about the actors that have the responsibility to handle alerts and crisis. |
| extends | icrash.concepts.primarytypes.classes.ctAuthenticated |
| attribute | crisisType: <code>etCrisisType</code> used to identify crisisType for which coordinator is assigned. |
| attribute | geographicalLocation: <code>etGeographicalLocation</code> used to identify geographical location for which coordinator is assigned. |
| attribute | id: <code>dtCoordinatorID</code> a unique identification information. |

continues in next page ...

... Classes table continuation

| | |
|-----------------|--|
| operation | init(Aid:dtCoordinatorID, Alogin:dtLogin, Apwd:dtPassword, AphoneNumber:dtPhoneNumber, AgeographicalLocation:etGeographicalLocation, AcrisisType:etCrisisType) :ptBoolean used to initialize the current object as a new instance of the ctCoordinator type. |
| ctCrisis | |
| | Used to model crisis that are inferred from the reception of at least one alert message. Crisis are entities that are handled by the <i>iCrash</i> system. |
| attribute | comment: dtComment a textual description providing unstructured information on the crisis handling. |
| attribute | id: dtCrisisID the crisis unique identification information. |
| attribute | instant: dtDateAndTime the date and time at which the first related alert notification has been sent. |
| attribute | location: dtGPSLocation the position of the crisis equal to the one of the first alert received and associated to the crisis. |
| attribute | status: etCrisisStatus the crisis handling status. |
| attribute | type: etCrisisType an indication of the gravity of the crisis. |
| operation | handlingDelayPassed() :ptBoolean used to determine if the crisis stood too long in a pending status since last reminder. |
| operation | init(Aid:dtCrisisID, Atype:etCrisisType, Astatus:etCrisisStatus, Alocation:dtGPSLocation, Ainstant:dtDateAndTime, Acomment:dtComment) :ptBoolean used to initialize the current object as a new instance of the ctAlert type. |
| operation | isAllocatedIfPossible() :ptBoolean used to allocate a crisis to a coordinator if any or to alert the administrator of crisis waiting to be handled. |
| operation | isSentToCoordinator(AactCoordinator:actCoordinator) :ptBoolean used to provide a given coordinator with current crisis information. |
| operation | maxHandlingDelayPassed() :ptBoolean used to determine if the crisis stood too long in a pending status since its creation. |
| ctHuman | |
| | used to model system's representation about the indirect actors that have alerted of potential crisis. |
| attribute | id: dtPhoneNumber the number of the communication device used to send an alert to <i>iCrash</i> system. |
| attribute | kind: etHumanKind role with respect to the alert notified. |
| operation | init(Aid:dtPhoneNumber, Akind:etHumanKind) :ptBoolean init: used to initialize the current object as a new instance of the ctHuman type. |
| ctState | |
| | used to model the system. Each system specified using Messir must include a ctState class for which there is only one instance at any state of the abstract machine after creation. |
| attribute | clock: dtDateAndTime used to represent the system local time. |
| attribute | crisisReminderPeriod: dtSecond |

continues in next page ...

... Classes table continuation

| | |
|-----------|--|
| | used to define the delay between two reminders after which a reminder must be sent to the administrator and to the known coordinators to encourage them to handle the crisis. |
| attribute | maxCrisisReminderPeriod: dtSecond used to define the maximum delay after which the crisis is randomly allocated to a coordinator if any or an alert message is sent to the administrator in order to encourage him to add coordinators. |
| attribute | nextValueForAlertID: dtInteger nextValueForAlertID: dtInteger: used to associate each alert declared with a unique identification value. |
| attribute | nextValueForCrisisID: dtInteger used to associate each crisis declared with a unique identification value. |
| attribute | vpLastReminder: dtDateAndTime date and time of the last reminder. |
| attribute | vpStarted: ptBoolean used to avoid reacting to an actor message if the system is not started (i.e. oeCreateSystemAndEnvironment not executed). |
| operation | init (AnextValueForAlertID:dtInteger, AnextValueForCrisisID:dtInteger, Aclock:dtDateAndTime, AcrisisReminderPeriod:dtSecond, AmaxCrisisReminderPeriod:dtSecond, AvpLastReminder:dtDateAndTime, AvpStarted:ptBoolean) :ptBoolean used to initialize the current object as a new instance of the ctState type. |

4.4.2 Primary types - Datatypes types descriptions

The table below is providing comments on the graphical views given for the datatype types of the primary types.

| DATATYPES | |
|--|---|
| dtAlertID | |
| A string used to identify alerts. | |
| extends | dtString |
| operation | is () :ptBoolean used to determine which strings are considered as valid alert identifiers. |
| dtCode | |
| a datatype which generates the code | |
| attribute | generatedCode: dtString an attribute in dtString in which the code is stored |
| operation | is () :ptBoolean used to determine which strings are considered as valid generated codes. |
| dtComment | |
| a datatype made of a string value used to receive, store and send textual information about crisis and alerts. | |
| extends | dtString |
| operation | is () :ptBoolean used to determine which strings are considered as valid comments. |
| dtCoordinatorID | |
| A string used to identify coordinators. | |

continues in next page ...

... Datatypes table continuation

| | |
|---|--|
| <i>extends</i> | dtString |
| <i>operation</i> | is() :ptBoolean used to determine which strings are considered as valid coordinators identifiers. |
| dtCrisisID | |
| A string used to identify crisis. | |
| <i>extends</i> | dtString |
| <i>operation</i> | is() :ptBoolean used to determine which strings are considered as valid crisis identifiers. |
| dtGPSLocation | |
| used to define coordinates of geographical positions on earth. It is defined a couple made of a latitude and a longitude. | |
| <i>attribute</i> | latitude: dtLatitude for the latitude part of the coordinate. |
| <i>attribute</i> | longitude: dtLongitude for the longitude part of the coordinate. |
| <i>operation</i> | is() :ptBoolean used to determine which couples are considered as valid dtGPSLocation values. |
| <i>operation</i> | isNearTo (AGPSLocation:dtGPSLocation) :ptBoolean used to determine if locations are considered enough close to be treated as equivalent in the application domain context. |
| dtLatitude | |
| used to define a latitude value of a geographical positions on earth. | |
| <i>extends</i> | dtReal |
| <i>operation</i> | is() :ptBoolean used to determine which strings are considered as valid dtLatitude. |
| dtLogin | |
| a login string used to authentify an <i>iCrash</i> user | |
| <i>extends</i> | dtString |
| <i>operation</i> | is() :ptBoolean used to determine which strings are considered as valid dtLogin. |
| dtLongitude | |
| used to define a longitude value of a geographical positions on earth. | |
| <i>extends</i> | dtReal |
| <i>operation</i> | is() :ptBoolean used to determine which strings are considered as valid dtLongitude. |
| dtPassword | |
| a password string used to authentify an <i>iCrash</i> user | |
| <i>extends</i> | dtString |
| <i>operation</i> | is() :ptBoolean used to determine which strings are considered as valid dtPassword. |
| dtPhoneNumber | |
| a string used to store the phone number from the human declaring the crisis or the alert. | |
| <i>extends</i> | dtString |
| <i>operation</i> | is() :ptBoolean used to determine which strings are considered as valid dtPhoneNumber. |

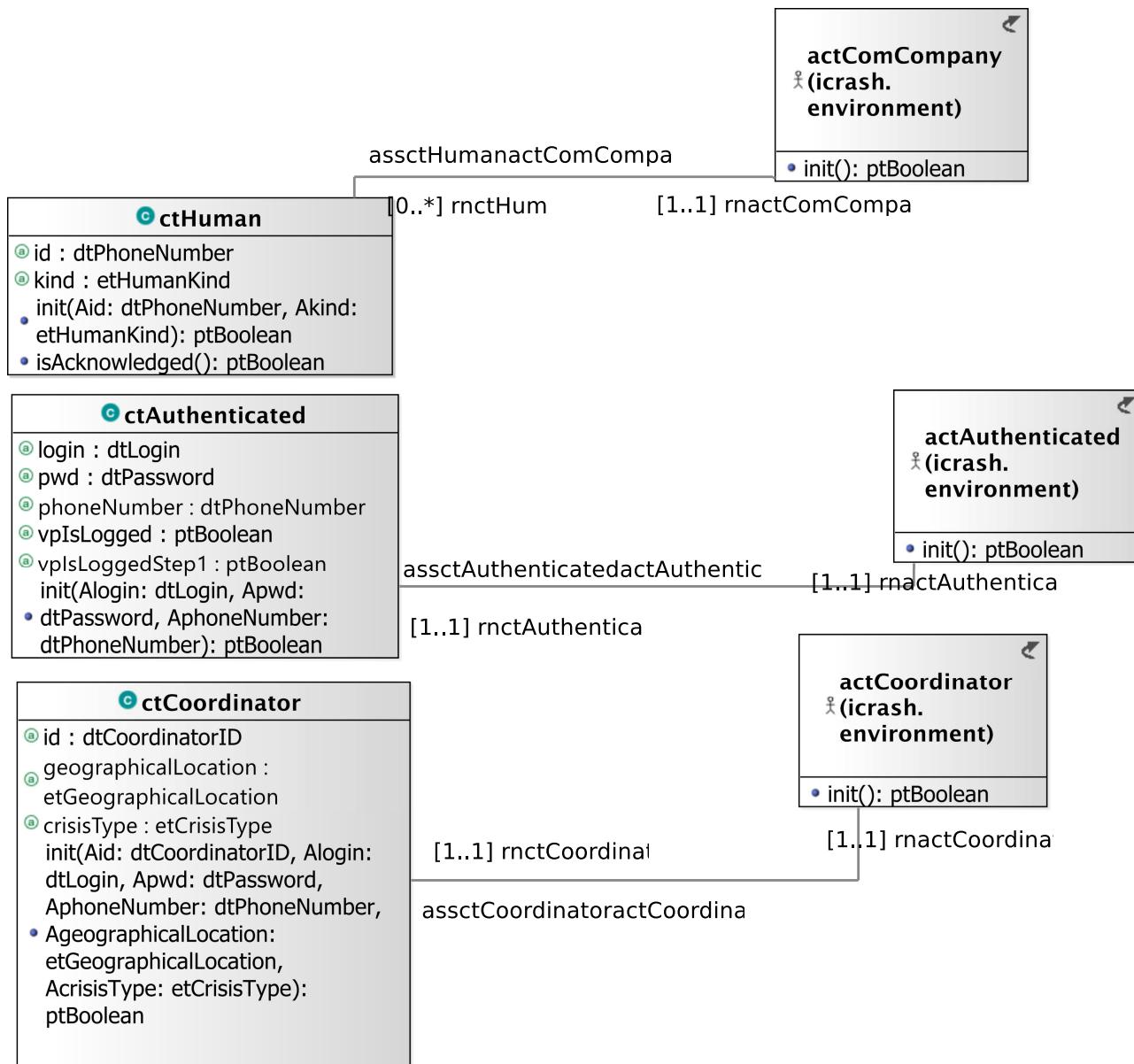


Figure 4.5: Concept Model - PrimaryTypes-Classes global view 01. Primary types class types global view - cm-pt-ct-gv-01 .

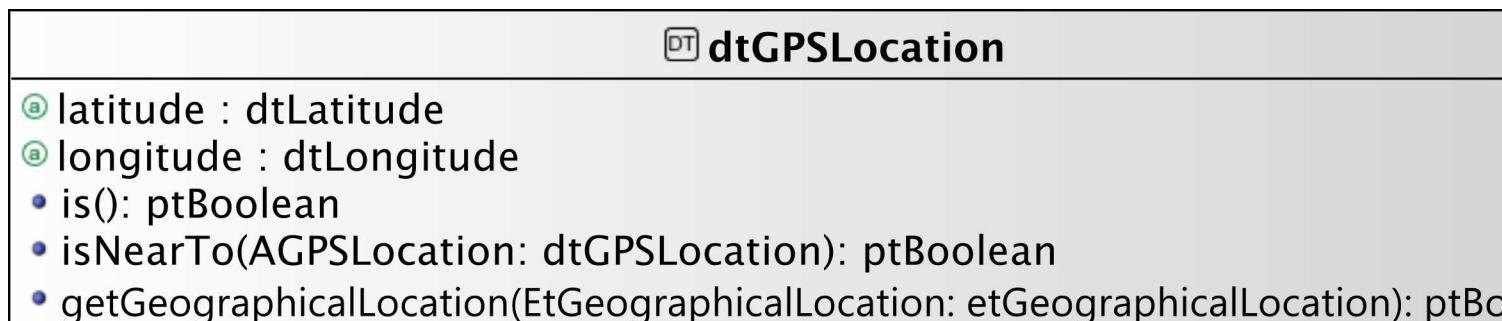


Figure 4.6: Concept Model - PrimaryTypes-Datatypes local view 06. .

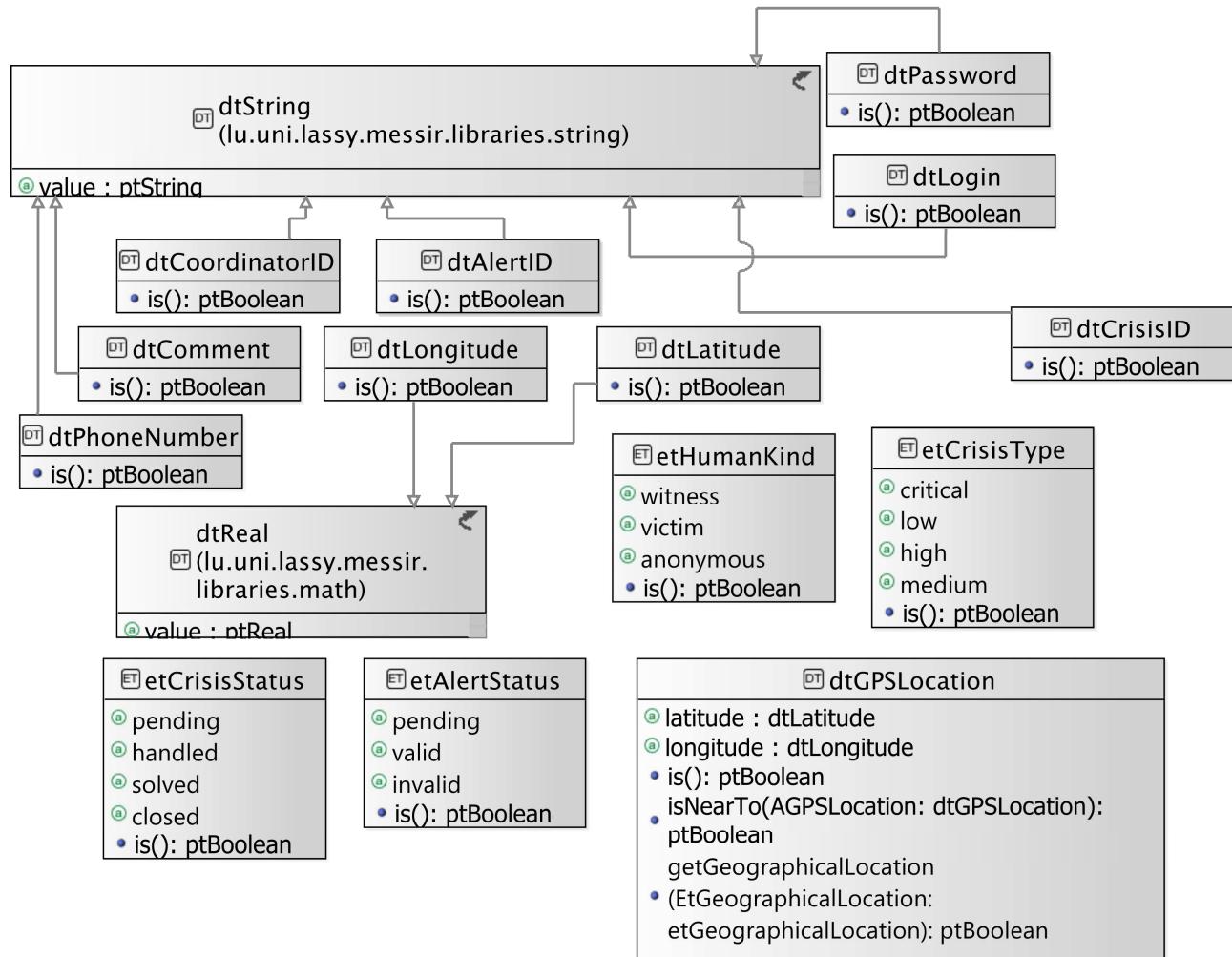


Figure 4.7: Concept Model - PrimaryTypes-Datatypes global view 01. global view of primary types datatype types - cm-pt-dt-gv-01 .

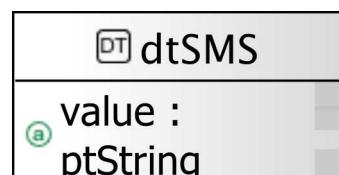


Figure 4.8: Concept Model - SecondaryTypes-Datatypes local view 01. Local view of the secondary types datatype types.

| ENUMERATIONS | |
|--|--|
| <i>etAlertStatus</i> | |
| this type is used to indicate the different validation status of an alert. | |
| operation <i>is() :ptBoolean</i> | used to determine which litteral belongs to the enumeration. |
| <i>etCrisisStatus</i> | |
| this type is used to indicate the different handling status of a crisis. | |
| operation <i>is() :ptBoolean</i> | used to determine which litteral belongs to the enumeration. |
| <i>etCrisisType</i> | |
| this type is used to indicate the different types of a crisis. | |
| operation <i>is() :ptBoolean</i> | used to determine which litteral belongs to the enumeration. |
| <i>etGeographicalLocation</i> | |
| this type is used to indicate the different types of geographical locations. | |
| operation <i>is() :ptBoolean</i> | used to determine which litteral belongs to the enumeration. |
| <i>etHumanKind</i> | |
| this type is used to indicate the kind of human that informs about a car crash crisis. | |
| operation <i>is() :ptBoolean</i> | used to determine which litteral belongs to the enumeration. |

4.4.3 Primary types - Association types descriptions

The table below is providing comments on the association types of the primary types.

| UNDIRECTED ASSOCIATIONS | |
|--|---|
| <i>assctAlertctCrisis</i> | a crisis is related to one or more alerts as the alerts judged to concern all the same crisis due to their location. An alert alerts exactly one crisis. |
| <i>assctAlertctHuman</i> | alerts are notified by human through the communication company. We need to keep an internal representation of those human to allow for communication of alert handling. |
| <i>assctAuthenticatedactAuthenticated</i> | mainly used to determine if the login request of an authenticated actor can be granted based on the given credentials and the registered ones. |
| <i>assctCoordinatoractCoordinator</i> | frequent messages must be sent to coordinator especially in relation to crisis they handle. |
| <i>assctCrisisctCoordinator</i> | at any point in time we need to know if a coordinator is handling existing crisis or not. |
| <i>assctHumanactComCompany</i> | in order to communicate with humans who informed about potential crisis, we need to record the communication company to use to send them messages. |

4.4.4 Primary types - Aggregation types descriptions

There are no aggregation types for the primary types.

4.4.4.1 Primary types - Composition types descriptions

There are no composition types for the primary types.

4.4.5 Secondary types - Class types descriptions

There are no elements in this category in the system analysed.

4.4.6 Secondary types - Datatypes types descriptions

The table below is providing comments on the graphical views given for the datatype types of the secondary types.

| DATATYPES | |
|--------------|---|
| <i>dtSMS</i> | |
| | a datatype made of a string value used to send textual information to human mobile devices. |
| attribute | value: ptString the textual information. |
| operation | is() :ptBoolean used to determine which strings are considered as valid comments. |

4.4.7 Secondary types - Association types descriptions

There are no association types for the secondary types.

4.4.8 Secondary types - Aggregation types descriptions

There are no aggregation types for the secondary types.

4.4.9 Secondary types - Composition types descriptions

There are no composition types for the secondary types.

Chapter 5

Operation Model

This section contains the operation schemes of each operation defined in either an actor, its output interface, in a primary or secondary type (class, datatype or enumeration types). The **Messip** OCL code listing is joined to the comment table.

5.1 Environment - Out Interface Operation Scheme for actActivator

5.1.1 Operation Model for oeSetClock

The oeSetClock operation has the following properties:

| OPERATION | |
|---|--|
| <i>oeSetClock[proactive]</i> | |
| An active message used to statically set the date and time information in the system's state. | |
| <i>Parameters</i> | |
| 1 | AcurrentClock: dtDateAndTime the date and time to be considered as the actual one. |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Pre-Condition (protocol)</i> | |
| PreP 1 | the system is supposed to be created and initialized and the provided date and time value is greater than the one known by the system. |
| <i>Pre-Condition (functional)</i> | |
| PreF 1 | none |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | the ctState instance post-state is updated to have its clock attribute equal to the given date and time. |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | none |

The listing 5.1 provides the **Messip** (MCL-oriented) specification of the operation.

```
1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
```

```

4  let AvpStarted: ptBoolean in
5
6 /* PreP01 */
7 self.rnActor.rnSystem = TheSystem
8 and self.rnActor.rnSystem.vpStarted = AvpStarted
9 and AvpStarted = true
10 and TheSystem.clock.lt(AcurrentClock) }
11
12 /* Pre Functional:*/
13 preF{true}
14
15 /* Post Functional:*/
16 postF{let TheSystem: ctState in
17 self.rnActor.rnSystem = TheSystem
18
19 /* PostF01 */
20 and TheSystem@post.clock = AcurrentClock}
21
22 /* Post Protocol:*/
23 postP{ true}

```

Listing 5.1: **Messir** (MCL-oriented) specification of the operation *oeSetClock*.

The listing 5.2 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%-----%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%-----%
5%-----%
6msrop(outactActivator,
7 oeSetClock,
8 [preProtocol,Self,
9 AcurrentClock
10 ],
11 []):-!
12/* Pre Protocol:*/
13/* PreP01 */
14 msrVar(ctState,TheSystem),
15 msrVar(ptBoolean,AvpStarted),
16
17 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
18
19 msrNav([Self],[rnActor,rnSystem,vpStarted],[AvpStarted]),
20 AvpStarted = [ptBoolean,true],
21
22 msrNav([TheSystem],
23 [clock,lt,[AcurrentClock]],
24 [[ptBoolean,true]])!
25 .
26
27msrop(outactActivator,
28 oeSetClock,
29 [preFunctional,Self,
30 AcurrentClock
31 ],
32 []):-!
33/* Pre Functional:*/
34/* PreF01 */
35true.
36
37msrop(outactActivator,
38 oeSetClock,
39 [post,Self,
40 AcurrentClock
41 ],

```

```

42      []):-  

43  

44 msrVar(ctState,TheSystem),  

45  

46 /* Post Functional:*/  

47  

48 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

49  

50 /* PostF01 */  

51 msrNav([TheSystem],  

52     [msmAtPost,clock],  

53     [AcurrentClock]),  

54  

55 /* Post Protocol:*/  

56 /* PostP01 */  

57 true  

58 .

```

Listing 5.2: **Messip** (Prolog-oriented) implementation of the operation *oeSetClock*.

5.1.2 Operation Model for oeSollicitateCrisisHandling

The *oeSollicitateCrisisHandling* operation has the following properties:

| OPERATION |
|---|
| <i>oeSollicitateCrisisHandling[proactive]</i> |
| A proactive message (message of a pro-active actor with no parameter triggered automatically if the pre protocol condition is true) used to avoid crisis to stay too long in an not handled status. |
| <i>Return type</i> |
| ptBoolean |
| <i>Pre-Condition (protocol)</i> |
| PreP 1 the system is started |
| PreP 2 there exist some crisis that are in pending status and for which the duration between the current ctState clock information and the last reminder is greater than the crisis reminder period duration. |
| <i>Pre-Condition (functional)</i> |
| PreF 1 none |
| <i>Post-Condition (functional)</i> |
| PostF 1 if there exist coordinators and crisis who stood in a not handled status more than the maximum allowed time then those crisis are randomly allocated to the existing coordinators. |
| PostF 2 for all other crisis who stood too longly in a not handled status but not more than the maximum delay allowed then a reminder message is sent to the administrator and all coordinator actors of the environment to sollicitate handling of those crisis. |
| <i>Post-Condition (protocol)</i> |
| PostP 1 the value of the last reminder known by the system at post state is the system's clock value. |

The listing 5.3 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  

2 /* Pre Protocol:*/  

3 prep{let TheSystem: ctState in  

4 let AvpStarted: ptBoolean in  

5 let ColctCrisisToHandle:

```

```

6     Bag(ctCrisis) in
7
8     self.rnActor.rnSystem = TheSystem
9
10    /* PreP01 */
11    and TheSystem.vpStarted
12
13    /* PreP02 */
14    and TheSystem.rnctCrisis->select(handlingDelayPassed())
15        = ColctCrisisToHandle
16    and ColctCrisisToHandle->size().geq(1)
17
18    /* Pre Functional:*/
19    preF{true}
20
21    /* Post Functional:*/
22    postF{let TheSystem: ctState in
23        let AMesssageForCrisisHandlers: dtComment in
24        let ColctCrisisToAllocateIfPossible:Bag(ctCrisis) in
25
26        self.rnActor.rnSystem = TheSystem
27        /* PostFO1 */
28        and TheSystem.rnctCrisis->select(maxHandlingDelayPassed())
29            = ColctCrisisToAllocateIfPossible
30        and ColctCrisisToAllocateIfPossible->forAll(isAllocatedIfPossible())
31
32        /* PostFO2 */
33        and TheSystem.rnctCrisis->select(handlingDelayPassed())
34        = ColctCrisisToHandle
35
36        and ColctCrisisToHandle->msrColSubtract(ColctCrisisToAllocateIfPossible)
37            = ColctCrisisToRemind
38
39        and if (ColctCrisisToRemind->size().geq(1))
40            then (AMesssageForCrisisHandlers.value
41                ='There are alerts pending since more than the defined delay. Please REACT !'
42            and TheSystem.rnactAdministrator.
43                rnInterfaceIN^ieMessage(AMesssageForCrisisHandlers)
44            and TheSystem.rnactCoordinator
45                ->forAll(rnInterfaceIN^ieMessage(AMesssageForCrisisHandlers))
46            )
47        else true
48        endif}
49
50    /* Post Protocol:*/
51    postP{ let TheSystem: ctState in
52        let TheClock: dtDateAndTime in
53
54        self.rnActor.rnSystem = TheSystem
55        and TheSystem.clock = TheClock
56        and TheSystem@post.vpLastReminder = TheClock}

```

Listing 5.3: **Messsir** (MCL-oriented) specification of the operation *oeSollicitateCrisisHandling*.

The listing 5.4 provides the **Messsir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6
7msrop(outactActivator,
8    oeSollicitateCrisisHandling,
9    [preProtocol,Self
10   ],

```

```

11     []):-  

12 /* Pre Protocol:*/  

13 msrVar(ctState,TheSystem),  

14 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

15  

16 msrVarCol(ctCrisis,_,ColctCrisisToHandle),  

17  

18 /* PreP01 */  

19 msrNav([TheSystem],  

20     [vpStarted],  

21     [[ptBoolean,true]]),  

22  

23 /* PreP02 */  

24 msrNav([TheSystem],  

25     [rnctCrisis,msrSelect,  

26      handlingDelayPassed,[]]  

27 ],  

28 ColctCrisisToHandle),  

29  

30 msrNav(ColctCrisisToHandle,  

31     [msrSize,geq,[[ptInteger,1]]],  

32     [[ptBoolean,true]]))  

33.  

34  

35 msrop(outactActivator,  

36     oeSollicitateCrisisHandling,  

37     [preFunctional,Self  

38     ],  

39     []):-  

40 /* Pre Functional:*/  

41 /* PreF01 */  

42 true.  

43  

44 msrop(outactActivator,  

45     oeSollicitateCrisisHandling,  

46     [post,Self  

47     ],  

48     []):-  

49  

50 msrVar(ctState,TheSystem),  

51 msrVar(dtComment,AMessageForCrisisHandlers),  

52 msrVar(dtDateAndTime, TheClock),  

53 msrVarCol(ctCrisis,_,ColctCrisisToAllocateIfPossible),  

54  

55 /* Post Functional:*/  

56 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

57  

58 /* PostF01 */  

59 msrNav([TheSystem],  

60     [rnctCrisis,msrSelect,  

61      maxHandlingDelayPassed,[]]  

62 ],  

63 ColctCrisisToAllocateIfPossible),  

64  

65 msrNav(ColctCrisisToAllocateIfPossible,  

66     [msrForAll,isAllocatedIfPossible,[],  

67     [[ptBoolean,true]]]),  

68  

69 /* PostF02 */  

70 msrNav([TheSystem],  

71     [rnctCrisis,msrSelect,  

72      handlingDelayPassed,[]]  

73 ],  

74 ColctCrisisToHandle),  

75  

76 msrNav(ColctCrisisToHandle,  

77     [msrColSubtract,[ColctCrisisToAllocateIfPossible]  

78     ],  

79 ColctCrisisToRemind),  

80

```

```

81 (msrNav([ColctCrisisToRemind,
82   [msrSize,geq,[[ptInteger,1]]],
83   [[ptBoolean,true]]]
84 -> (msrNav([AMessageForCrisisHandlers],
85   [value],
86   [[ptString,'There are alerts pending since more than the defined delay. Please REACT !']])),
87
88 msrNav([TheSystem],
89   [rnactAdministrator,rnInterfaceIN,
90   ieMessage,[AMessageForCrisisHandlers]
91 ],
92   [[ptBoolean,true]]),
93
94 msrNav([TheSystem],
95   [rnactCoordinator,msrForAll,rnInterfaceIN,
96   ieMessage,[AMessageForCrisisHandlers]
97 ],
98   [[ptBoolean,true]]))
99 )
100 ; true
101 ),
102
103 /* Post Protocol:*/
104 /* PostP01 */
105 msrNav([TheSystem],
106   [clock],
107   [TheClock]),
108
109 msrNav([TheSystem],
110   [msmAtPost,vpLastReminder],
111   [TheClock])
112 .

```

Listing 5.4: **Messip** (Prolog-oriented) implementation of the operation *oeSollicitateCrisisHandling*.

Figure 5.1 shows concept model elements in the scope of the *oeSollicitateCrisisHandling* operation

5.2 Environment - Out Interface Operation Scheme for actAdministrator

5.2.1 Operation Model for *oeAddCoordinator*

The *oeAddCoordinator* operation has the following properties:

| OPERATION | |
|--|--|
| <i>oeAddCoordinator</i> | sent to add a new coordinator in the system's post state and environment's post state. |
| <i>Parameters</i> | |
| 1 AdtCoordinatorID: dtCoordinatorID | used to initialize the id field |
| 2 AdtLogin: dtLogin | used to initialize the login field |
| 3 AdtPassword: dtPassword | used to initialize the password field |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Pre-Condition (protocol)</i> | |

continues in next page ...

...Operation table continuation

| | |
|------------------------------------|--|
| PreP 1 | the system is started |
| PreP 2 | the actor logged previously and did not log out ! (i.e. the associated ctAdministrator instance is considered logged) |
| Pre-Condition (functional) | |
| PreF 1 | it is supposed that there cannot exist a ctCoordinator instance with the same id attribute as the one the administrator wants to delete. |
| Post-Condition (functional) | |
| PostF 1 | the environment has a new instance of coordinator actor allowing for input/output message communication with the system. |
| PostF 2 | the system's state has a new instance of ctCoordinator initialized with the given values. |
| PostF 3 | the new actor instance and ctCoordinator instance are related. |
| PostF 4 | the new actor instance and ctCoordinator instance are related according to the authenticated association. |
| PostF 5 | the administrator actor is informed about the satisfaction of its request. |
| Post-Condition (protocol) | |
| PostP 1 | none |

The listing 5.5 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol:*/
2  preP{let TheSystem: ctState in
3    let TheActor:actAdministrator in
4
5
6    self.rnActor.rnSystem = TheSystem
7    and self.rnActor = TheActor
8
9  /* PreP01 */
10 and TheSystem.vpStarted = true
11 /* Prep02 */
12 and TheActor.rnctAuthenticated.vpIsLogged = true}
13
14 /* Pre Functional:*/
15 preF{let TheSystem: ctState in
16  let TheActor:actAdministrator in
17  let ColctCoordinators:Bag(ctCoordinator) in
18
19  self.rnActor.rnSystem = TheSystem
20  and self.rnActor = TheActor
21 /* Prep01 */
22  and TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
23    = ColctCoordinators
24  and ColctCoordinators->isEmpty() = true}
25
26 /* Post Functional:*/
27 postF{let TheSystem: ctState in
28  let TheactCoordinator:actCoordinator in
29  let ThectCoordinator:ctCoordinator in
30  self.rnActor.rnSystem = TheSystem
31  and self.rnActor = TheActor
32 /* PostF01 */
33  TheactCoordinator.init()
34 /* PostF02 */
35  and ThectCoordinator.init(AdtCoordinatorID,
36    AdtLogin,
37    AdtPassword,
38    AdtPhoneNumber,
```

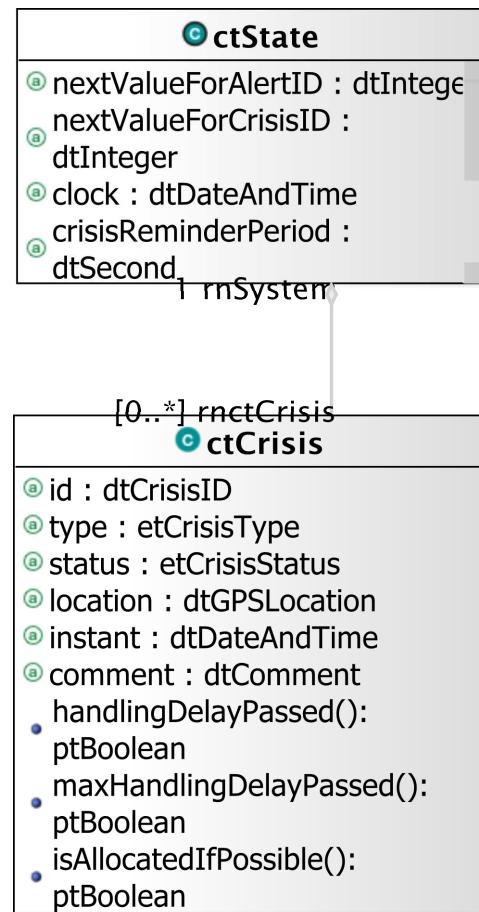


Figure 5.1: oeSollicitateCrisisHandling operation scope

```

39      AetGeographicalLocation,
40      AetCrisisType)
41
42 /* PostF03 */
43 and TheactCoordinator@post.rnctCoordinator = TheactCoordinator
44
45 /* PostF04 */
46 and TheactCoordinator@post.rnactAuthenticated = TheactCoordinator
47
48 /* PostF05 */
49 and TheActor.rnInterfaceIN^ieCoordinatorAdded() }
50
51 /* Post Protocol:*/
52 postP{ true}

```

Listing 5.5: **Messir** (MCL-oriented) specification of the operation *oeAddCoordinator*.

The listing 5.6 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%-----%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%-----%
5-----
6msrop(outactAdministrator,
7    oeAddCoordinator,
8    [preProtocol,Self,
9     AdtCoordinatorID,
10    AdtLogin,
11    AdtPassword
12   ],
13   []):-!
14/* Pre Protocol:*/
15 msrVar(ctState,TheSystem),
16 msrVar(actAdministrator,TheActor),
17 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
18 msrNav([Self],[rnActor],[TheActor]),
19
20/* PreP01 */
21 msrNav([TheSystem],
22        [vpStarted],
23        [[ptBoolean,true]]),
24
25/* PreP02 */
26 msrNav([TheActor],
27        [rnctAuthenticated,vpIsLogged],
28        [[ptBoolean,true]]),
29
30 .
31
32msrop(outactAdministrator,
33    oeAddCoordinator,
34    [preFunctional,Self,
35     AdtCoordinatorID,
36     AdtLogin,
37     AdtPassword
38   ],
39   []):-!
40/* Pre Functional:*/
41 msrVar(ctState,TheSystem),
42 msrVar(actAdministrator,TheActor),
43 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
44 msrNav([Self],[rnActor],[TheActor]),
45/* PreF01 */
46 msrNav([TheSystem],
47        [rnctCoordinator,

```

```

48     msrSelect,id,eq,[AdtCoordinatorID]],
49     ColctCoordinators),
50 msrNav(ColctCoordinators,
51     [msrIsEmpty],
52     [[ptBoolean,true]]))
53 .
54
55msrop(outactAdministrator,
56 oeAddCoordinator,
57 [post,Self,
58 AdtCoordinatorID,
59 AdtLogin,
60 AdtPassword
61 ],
62 []):-.
63
64/* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actAdministrator,TheActor),
67 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
68 msrNav([Self],[rnActor],[TheActor]),
69
70 msrVar(actCoordinator,TheactCoordinator),
71 msrVar(ctCoordinator,ThectCoordinator),
72
73/* PostF01 */
74 msrNav([TheactCoordinator],
75     [init,[]],
76     [[ptBoolean,true]]),
77
78/* PostF02 */
79 msrNav([ThectCoordinator],
80     [init,[AdtCoordinatorID,AdtLogin,AdtPassword]],
81     [[ptBoolean,true]]),
82
83/* PostF03 */
84 msrNav([TheactCoordinator],
85     [msmAtPost,rnctCoordinator],
86     [ThectCoordinator]),
87
88/* PostF04 */
89 msrNav([ThectCoordinator],
90     [msmAtPost,rnactAuthenticated],
91     [TheactCoordinator]),
92
93/* PostF05 */
94 msrNav([TheActor],
95     [rnInterfaceIN,
96     ieCoordinatorAdded,[]],
97     [[ptBoolean,true]]),
98
99 /* Post Protocol:*/
100/* PostP01 */
101 true
102 .

```

Listing 5.6: **Messir** (Prolog-oriented) implementation of the operation *oeAddCoordinator*.

5.2.2 Operation Model for *oeDeleteCoordinator*

The *oeDeleteCoordinator* operation has the following properties:

| OPERATION |
|---|
| <i>oeDeleteCoordinator</i> |
| sent to delete an existing coordinator in the system's post state and environment's post state. |

continues in next page ...

...Operation table continuation

| <i>Parameters</i> | |
|------------------------------------|--|
| 1 | AdtCoordinatorID: dtCoordinatorID used for ctCoordinator instance retrieval |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Pre-Condition (protocol)</i> | |
| PreP 1 | the system is started |
| PreP 2 | the actor logged previously and did not log out ! (i.e. the associated ctAdministrator instance is considered logged) |
| <i>Pre-Condition (functional)</i> | |
| PreF 1 | it is supposed that there exist one ctCoordinator instance with the same id attribute than the one the administrator wants to create. |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | the ctCoordinator class instance having the required id do not belong anymore to the post state as well as is related actCoordinator actor instance. |
| PostF 2 | the administrator actor is informed about the satisfaction of its request. |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | none |

The listing 5.7 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol*/
2  preP{let TheSystem: ctState in
3    let TheActor:actAdministrator in
4
5
6    self.rnActor.rnSystem = TheSystem
7    and self.rnActor = TheActor
8
9  /* PreP01 */
10   and TheSystem.vpStarted = true
11  /* Prep02 */
12  and TheActor.rnctAuthenticated.vpIsLogged = true}
13
14 /* Pre Functional*/
15 pref{let TheSystem: ctState in
16  let TheActor:actAdministrator in
17
18  self.rnActor.rnSystem = TheSystem
19  and self.rnActor = TheActor
20 /* PreF01 */
21  TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
22  = ColctCoordinators
23  and ColctCoordinators->size().eq(1)}
24
25 /* Post Functional*/
26 postF{let TheSystem: ctState in
27  let TheActor:actAdministrator in
28  let ThectCoordinator:ctCoordinator in
29  self.rnActor.rnSystem = TheSystem
30  and self.rnActor = TheActor
31 /* PostF01 */
32  TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
33  = ThectCoordinator
34  and ThectCoordinator.rnactCoordinator->forAll(msrIsKilled)
35  and ThectCoordinator.msrIsKilled

```

```

36  /* PostF02 */
37  and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
38
39  /* Post Protocol:*/
40  /* PostP01 */
41  and true}
42
43
44  /* Post Protocol:*/
45  postP{ true}

```

Listing 5.7: **Messir** (MCL-oriented) specification of the operation *oeDeleteCoordinator*.

The listing 5.8 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%
5%-----%
6msrop(outactAdministrator,
7    oeDeleteCoordinator,
8    [preProtocol,Self,
9     AdtCoordinatorID
10    ],
11    []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actAdministrator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]]))
26.
27
28msrop(outactAdministrator,
29    oeDeleteCoordinator,
30    [preFunctional,Self,
31     AdtCoordinatorID
32    ],
33    []):-!
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actAdministrator,TheActor),
37 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
38 msrNav([Self],[rnActor],[TheActor]),
39
40/* PreF01 */
41 msrNav([TheSystem],
42     [rnctCoordinator,
43      msrSelect,id,eq,[AdtCoordinatorID]],
44     ColctCoordinators),
45
46 msrNav(ColctCoordinators,
47     [msrSize,eq,[[ptInteger,1]]],
48     [[ptBoolean,true]]).
49
50msrop(outactAdministrator,
51    oeDeleteCoordinator,

```

```

52 [post,Self,
53 AdtCoordinatorID
54 ],
55 []):-
56
57/* Post Functional:*/
58 msrVar(ctState,TheSystem),
59 msrVar(actAdministrator,TheActor),
60 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
61 msrNav([Self],[rnActor],[TheActor]),
62
63/* PostF01 */
64 msrNav([TheSystem],
65 [rnctCoordinator,
66 msrSelect,id,eq,[AdtCoordinatorID]],
67 [ThectCoordinator]),
68
69 msrNav([ThectCoordinator],
70 [rnactCoordinator,msrForAll,msrIsKilled],
71 [[ptBoolean,true]]),
72
73 msrNav([ThectCoordinator],
74 [msrIsKilled],
75 [[ptBoolean,true]]),
76
77 /* PostF02 */
78 msrNav([TheActor],
79 [rnInterfaceIN,
80 ieCoordinatorDeleted,[]]
81 ],
82 [[ptBoolean,true]]),
83
84 /* Post Protocol:*/
85/* PostP01 */
86 true
87 .

```

Listing 5.8: **Messip** (Prolog-oriented) implementation of the operation *oeDeleteCoordinator*.

5.2.3 Operation Model for oeEditCoordinator

The *oeEditCoordinator* operation has the following properties:

| OPERATION |
|---|
| <i>oeEditCoordinator</i> |
| sent to edit an existing coordinator in the system's post state and environment's post state. |
| Parameters |
| 1 AdtCoordinatorID: dtCoordinatorID used for ctCoordinator instance retrieval 2 AetGeographicalLocation: etGeographicalLocation the parameter to which current geographical location of coordinator will be changed 3 AetCrisisType: etCrisisType the parameter to which current crisis type of coordinator will be changed |
| Return type |
| ptBoolean |
| Pre-Condition (protocol) |
| PreP 1 the system is started PreP 2 the actor logged previously and did not log out ! (i.e. the associated ctAdministrator instance is considered logged) |

continues in next page ...

... Operation table continuation

| | |
|---|---|
| PreP 3 | the coordinator with the given ID is not logged in. It means that vpIsLogged of the coordinator is false |
| <i>Pre-Condition (functional)</i> | |
| PreF 1 | it is supposed that there exist one ctCoordinator instance with the same id attribute than the one the administrator wants to edit. |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | the ctCoordinator class instance having the required id now has updated geographical location and crisis type . |
| PostF 2 | the administrator actor is informed about the satisfaction of its request. |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | none |

5.3 Environment - Out Interface Operation Scheme for actAuthenticated

5.3.1 Operation Model for oeLogin

The oeLogin operation has the following properties:

| OPERATION | |
|--|--|
| <i>oeLogin</i> | |
| sent to request authorization to request access secured system operations. | |
| <i>Parameters</i> | |
| 1 | AdtLogin: dtLogin first information used to determine accessibility rights for the actual actor. |
| 2 | AdtPassword: dtPassword second information used to determine accessibility rights for the actual actor. |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Pre-Condition (protocol)</i> | |
| PreP 1 | the system is started |
| PreP 2 | the actor is not already logged in ! (i.e. the associated ctAuthenticated instance is not considered logged) |
| <i>Pre-Condition (functional)</i> | |
| PreF 1 | none |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | if the login and password provided by the actor correspond to the ones that belong to the ctAuthenticated instance he is related to then a message telling the user that password and login are correct is sent to the actor.; else the actor is notified that he gave incorrect data and all the administrator actors existing in the environement are notified of an intrusion temptative. |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | if the authentication information is correct then a code is generated and is sent to phone number of the actor. |
| PostP 2 | |

The listing 5.9 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol*/
2  preP{let TheSystem: ctState in
3    let TheActor:actAuthenticated in
4      self.rnActor.rnSystem = TheSystem
5      and self.rnActor = TheActor
6
7
8  /* PreP01 */
9  and TheSystem.vpStarted = true
10 /* PreP02 */
11 and TheActor.rnctAuthenticated.vpIsLogged = false
12 and TheActor.rnctAuthenticated.vpIsLoggedStep1 = false}
13
14 /* Pre Functional*/
15 preF{/* PreF01 */
16 true}
17
18 /* Post Functional*/
19 postF{let TheSystem: ctState in
20   let TheactAuthenticated:actAuthenticated in
21
22   let AptStringMessageForTheactAuthenticated: ptString in
23   let AptStringMessageForTheactAdministrator:ptString in
24
25   self.rnActor.rnSystem = TheSystem
26   and self.rnActor = TheactAuthenticated
27
28   and /* PostF01 */
29   if (TheactAuthenticated.rnctAuthenticated.pwd
30       = AdtPassword
31       and TheactAuthenticated.rnctAuthenticated.login
32       = AdtLogin
33       )
34   then (AptStringMessageForTheactAuthenticated.eq('Login and Password are correct ...')
35       and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
36       and TheSystem.rnactComCompany.rnInterfaceIN^ieSmsSend()
37       )
38   else (AptStringMessageForTheactAuthenticated
39       .eq('Wrong identification information ! Please try again ...')
40       and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
41       and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
42       and TheSystem.rnactAdministrator
43       .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
44       )
45   endif}
46
47 /* Post Protocol*/
48 postP{ let TheSystem: ctState in
49   let TheactAuthenticated:actAuthenticated in
50
51   self.rnActor.rnSystem = TheSystem
52   and self.rnActor = TheactAuthenticated
53   if (TheactAuthenticated.rnctAuthenticated.pwd
54       = AdtPassword
55       and TheactAuthenticated.rnctAuthenticated.login
56       = AdtLogin
57       )
58   then (TheactAuthenticated.rnctAuthenticated@post.vpIsLoggedStep1 = true)
59   else false
60   endif}

```

Listing 5.9: **Messip** (MCL-oriented) specification of the operation *oeLogin*.

The listing 5.10 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactAuthenticated,
7    oeLogin,
8    [preProtocol,Self,
9     AdtLogin,
10    AdtPassword
11    ],
12    []):-!
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actAuthenticated,TheactAuthenticated),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheactAuthenticated]),
18 .
19 /* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23 .
24 msrNav([TheactAuthenticated],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,false]])
27 .
28 .
29msrop(outactAuthenticated,
30    oeLogin,
31    [preFunctional,Self,
32     AdtLogin,
33     AdtPassword
34     ],
35    []):-!
36/* Pre Functional:*/
37/* PreF01 */
38true
39.
40 .
41msrop(outactAuthenticated,
42    oeLogin,
43    [post,Self,
44     AdtLogin,
45     AdtPassword
46     ],
47    []):-!
48 .
49 msrVar(ctState,TheSystem),
50 msrVar(actAuthenticated,TheactAuthenticated),
51 .
52 msrVar(ptString,AptStringMessageForTheactAuthenticated),
53 msrVar(ptString,AptStringMessageForTheactAdministrator),
54 .
55/* Post Functional:*/
56 .
57 msrNav([Self],[rnActor],[TheactAuthenticated]),
58 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
59 .
60/* PostF01 */
61 .
62 ( (msrNav([TheactAuthenticated],
63     [rnctAuthenticated,pwd],
64     [AdtPassword]),
65     msrNav([TheactAuthenticated],
66     [rnctAuthenticated,login],
67     [AdtLogin])
68   )
69 -> ( msrNav([AptStringMessageForTheactAuthenticated],
70     [eq,[[ptString,'You are logged ! Welcome ...']]],
```

```

71      [[ptBoolean,true]]),
72  msrNav([TheactAuthenticated],
73  [rnInterfaceIN,
74  ieMessage,[AptStringMessageForTheactAuthenticated]],
75  [[ptBoolean,true]])
76 )
77 ; ( msrNav([AptStringMessageForTheactAuthenticated],
78  [eq,[[ptString,'Wrong identification information ! Please try again ...']]),
79  [[ptBoolean,true]]),
80  msrNav([TheactAuthenticated],
81  [rnInterfaceIN,
82  ieMessage,[AptStringMessageForTheactAuthenticated]],
83  [[ptBoolean,true]]),
84
85  msrNav([AptStringMessageForTheactAdministrator],
86  [eq,[[ptString,'Intrusion tentative !']]),
87  [[ptBoolean,true]]),
88  msrNav([TheSystem],
89  [rnactAdministrator,rnInterfaceIN,
90  ieMessage,[AptStringMessageForTheactAdministrator]],
91  [[ptBoolean,true]])
92 )
93 ),
94
95 /* Post Protocol:*/
96 /* PostP01 */
97 ( (msrNav([TheactAuthenticated],
98  [rnctAuthenticated,pwd],
99  [AdtPassword]),
100 msrNav([TheactAuthenticated],
101  [rnctAuthenticated,login],
102  [AdtLogin])
103 )
104 -> (msrNav([TheactAuthenticated],
105  [rnctAuthenticated,msmAtPost,vpIsLogged],
106  [[ptBoolean,true]])
107 )
108 ; true
109 )
110 .

```

Listing 5.10: **Messip** (Prolog-oriented) implementation of the operation *oeLogin*.

5.3.2 Operation Model for oeSMS

The oeSMS operation has the following properties:

| OPERATION | |
|---------------------------------|---|
| oeSMS | sent to request authorization to request access secured system operations. |
| <i>Parameters</i> | |
| 1 | AdtString: dtString string which contains the code which will be compared with the one generated for authenticated user |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Pre-Condition (protocol)</i> | |
| PreP 1 | the system is started |
| PreP 2 | the actor is not already logged in ! (i.e. the associated ctAuthenticated instance is not considered logged) |
| PreP 3 | the actor's method oeLogin is executed and variable vpIsLoggedStep1 = true |

continues in next page ...

... Operation table continuation

| | |
|------------------------------------|---|
| PreP 4 | the actor has resived sms code on his telephone |
| Pre-Condition (functional) | |
| PreF 1 | none |
| Post-Condition (functional) | |
| PostF 1 | if the sms code provided by the actor correspond to the ones that belong to the ctAuthenticated instance he is related to then a welcome message is sent to the actor (n.b. the logged status is changed as a post-protocol condition). |
| Post-Condition (protocol) | |
| PostP 1 | if the sms code is correct then the actor is known to be logged in ! (i.e. the associated ctAuthenticated instance with given login and password is considered logged) |

The listing 5.11 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol:*/
2  preP{let TheSystem: ctState in
3    let TheActor:actAuthenticated in
4    self.rnActor.rnSystem = TheSystem
5    and self.rnActor = TheActor
6    /* PreP01 */
7    and TheSystem.vpStarted = true
8    /* PreP02 */
9    and TheActor.rnctAuthenticated.vpIsLogged = false
10   and TheActor.rnctAuthencitated.vpIsloggedStep1 = true)
11
12
13 /* Pre Functional:*/
14 preF{true}
15
16 /* Post Functional:*/
17 postF{let TheSystem: ctState in
18   let TheactAuthenticated:actAuthenticated in
19
20   let AptStringMessageForTheactAuthenticated: ptString in
21   let AptStringMessageForTheactAdministrator:ptString in
22
23   self.rnActor.rnSystem = TheSystem
24   and self.rnActor = TheactAuthenticated
25
26   and /* PostF01 */
27     if (TheactAuthenticated.rnctAuthenticated.smscode
28       = smsCode)
29     then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
30     and TheactAuthenticated.bnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
31     )
32     else false
33     endif)
34
35 /* Post Protocol:*/
36 postP{ let TheSystem: ctState in
37   let TheactAuthenticated:actAuthenticated in
38
39   self.rnActor.rnSystem = TheSystem
40   and self.rnActor = TheactAuthenticated
41   /* PostP01 */
42   if (TheactAuthenticated.rnctAuthenticated.smscode = smsCode)
43   then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
44   else false

```

```
45  endif}
```

Listing 5.11: **Messip** (MCL-oriented) specification of the operation *oeSMS*.

5.3.3 Operation Model for oeLogout

The *oeLogout* operation has the following properties:

| OPERATION |
|---|
| <i>oeLogout</i> |
| sent to end the secured access to specific system operations. |
| <i>Return type</i> |
| ptBoolean |
| <i>Pre-Condition (protocol)</i> |
| PreP 1 the system is started |
| PreP 2 the actor is currently logged in ! (i.e. the associated ctAuthenticated instance is considered logged) |
| <i>Pre-Condition (functional)</i> |
| PreF 1 |
| <i>Post-Condition (functional)</i> |
| PostF 1 a logout confirmation message is sent to the actor (n.b. the logged status is changed as a post-protocol condition) |
| <i>Post-Condition (protocol)</i> |
| PostP 1 the actor is known to be logged out ! (i.e. the associated ctAuthenticated instance with given login and password is considered logged out) |

The listing 5.12 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol:*/
2  prep{let TheSystem: ctState in
3    let TheActor:actAdministrator in
4    self.rnActor.rnSystem = TheSystem
5    and self.rnActor = TheActor
6
7
8  /* PreP01 */
9  and TheSystem.vpStarted = true
10 /* Prep02 */
11 and TheActor.rnctAuthenticated.vpIsLogged = true}
12
13 /* Pre Functional:*/
14 pref{/* PreF01 */
15 true}
16
17 /* Post Functional:*/
18 postF{let TheSystem: ctState in
19  let TheactAuthenticated:actAuthenticated in
20  let AptStringMessageForTheactAuthenticated: ptString in
21
22  self.rnActor.rnSystem = TheSystem
23  and self.rnActor = TheactAuthenticated
24
25 /* PostF01 */
26 AptStringMessageForTheactAuthenticated.eq('You are logged out ! Good Bye ...')
```

```

27   and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated) }
28
29 /* Post Protocol:*/
30 postP{ let TheSystem: ctState in
31   let TheactAuthenticated:actAuthenticated in
32
33   self.rnActor.rnSystem = TheSystem
34   and self.rnActor = TheactAuthenticated.asSet
35 /* PostP01 */
36   TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = false}

```

Listing 5.12: **Messir** (MCL-oriented) specification of the operation *oeLogout*.

The listing 5.13 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%
5-----%
6msrop(outactAuthenticated,
7  oeLogout,
8  [preProtocol,Self
9  ],
10 []):-
11/* Pre Protocol:*/
12 msrVar(ctState,TheSystem),
13 msrVar(actAuthenticated,TheActor),
14 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
15 msrNav([Self],[rnActor],[TheActor]),
16
17/* PreP01 */
18 msrNav([TheSystem],
19   [vpStarted],
20   [[ptBoolean,true]]),
21
22 msrNav([TheActor],
23   [rnctAuthenticated,vpIsLogged],
24   [[ptBoolean,true]])
25 .
26
27msrop(outactAuthenticated,
28  oeLogout,
29  [preFunctional,Self
30  ],
31  []):-
32/* Pre Functional:*/
33/* PreF01 */
34true
35.
36
37msrop(outactAuthenticated,
38  oeLogout,
39  [post,Self
40  ],
41  []):-
42
43 msrVar(ctState,TheSystem),
44 msrVar(actAuthenticated,TheactAuthenticated),
45
46 msrVar(ptString,AptStringMessageForTheactAuthenticated),
47
48/* Post Functional:*/
49 msrNav([Self],[rnActor],[TheactAuthenticated]),
50 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
51

```

```

52/* PostF01 */
53 msrNav([AptStringMessageForTheactAuthenticated],
54     [eq, [[ptString,'You are logged out ! Good Bye ...']]],,
55     [[ptBoolean,true]]),
56 msrNav([TheactAuthenticated],
57     [rnInterfaceIN,
58      ieMessage,[AptStringMessageForTheactAuthenticated]],,
59     [[ptBoolean,true]]),
60
61 /* Post Protocol:*/
62/* PostP01 */
63msrNav ([TheactAuthenticated],
64     [rnctAuthenticated,msmAtPost,vpIsLogged],,
65     [[ptBoolean,false]])
66.

```

Listing 5.13: **Messip** (Prolog-oriented) implementation of the operation *oeLogout*.

5.4 Environment - Out Interface Operation Scheme for actComCompany

5.4.1 Operation Model for oeAlert

The *oeAlert* operation has the following properties:

| OPERATION | |
|--|---|
| <i>oeAlert</i> | |
| Any human having a phone able to connect to the communication companies using the <i>iCrash</i> system can send his company an sms message with structured information in order to declare an alert. | |
| Parameters | |
| 1 | AetHumanKind: etHumanKind the kind of human informing of an alert. |
| 2 | AdtDate: dtDate the date of the alert |
| 3 | AdtTime: dtTime the time of the alert |
| 4 | AdtPhoneNumber: dtPhoneNumber the phone number of the human sending the alert SMS message |
| 5 | AdtGPSLocation: dtGPSLocation the GPS position of the phone at the date and time the message was sent. |
| 6 | AdtComment: dtComment a free text message sent by the human providing information on the alert that he wants to declare |
| Return type | |
| ptBoolean | |
| Pre-Condition (protocol) | |
| PreP 1 | the system is supposed to be created and initialized. |
| Pre-Condition (functional) | |
| PreF 1 | the date and time the alert is declared is supposed to be in the past with respect to the current time known by the system. |
| Post-Condition (functional) | |
| PostF 1 | the ctState attribute for the next value for alert IDs is incremented by one at post. |

continues in next page ...

... Operation table continuation

| | |
|---------|---|
| PostF 2 | a new alert instance exists in the post state with status pending, instant information (resp. GPS location and comment) based on date and time provided (resp. position and comment); and with alert ID being a string conversion of the dtInteger value available in the pre state in the ctState instance. |
| PostF 3 | if there exist no already registered alert near to the alert currently declared then a new crisis is added in the post state and initialized with: its ID being the one provided by the ctState instance (which is incremented by one in the post state), its type considered as small, its status being pending, its declared time being the same than the alert and a default comment indicating that a report will come later on. else the crisis to which the new alert must be related to is the one related to any alert nearby in the pre-state. |
| PostF 4 | the post state relates the new alert to the previously characterized crisis. |
| PostF 5 | if there is no ctHuman instance having same phone number and same kind in the pre-state then a new one is added in the post-state with given phone number and kind and is associated to the communication company actor used to declare the alert. else the pre-state one is chosen |
| PostF 6 | and this specified ctHuman is related to the new alert thus indicating he has signed the alert. |

Post-Condition (protocol)

| | |
|---------|------|
| PostP 1 | none |
|---------|------|

The listing 5.14 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol:*/
2  preP{let TheSystem: ctState in
3    self.rnActor.rnSystem = TheSystem
4
5
6  /* PreP01 */
7  and TheSystem.vpStarted = true}
8
9  /* Pre Functional:*/
10 preF{let TheSystem: ctState in
11   self.rnActor.rnSystem = TheSystem
12
13 /* PreF01 */
14 and (TheSystem.clock.date.gt(AdtDate)
15   or (TheSystem.clock.date.eq(AdtDate)
16   and TheSystem.clock.time.gt(AdtTime)
17   )
18  )
19
20 /* Post Functional:*/
21 postF{let TheSystem: ctState in
22
23  let ActHuman:ctHuman in
24  let TheactComCompany:actComCompany in
25  let ActAlert:ctAlert in
26  let AAlertInstant:dtDateAndTime in
27  let AetAlertStatus:etAlertStatus in
28  let ActAlertNearBy:ctAlert in
29  let ActCrisis:ctCrisis in
30  let AdtCrisisID:dtCrisisID in
31  let AetCrisisType:etCrisisType in
32  let AetCrisisStatus:etCrisisStatus in
33  let ACrisisInstant:dtDateAndTime in
34  let ACrisisdtComment:dtComment in
```

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```

35  let AptStringMessage:ptString in
36  let AdtSMS:dtSMS in
37  let AdtAlertID:dtAlertID in
38
39  self.rnActor.rnSystem = TheSystem
40  and self.rnActor = TheactComCompany
41 /* PostF01 */
42 TheSystem.nextValueForAlertID=PrenextValueForAlertID
43 and PrenextValueForAlertID.add(1) = PostnextValueForAlertID
44 and TheSystem@post.nextValueForAlertID = PostnextValueForAlertID
45
46 /* PostF02 */
47 and AAlertInstant.date=AdtDate
48 and AAlertInstant.time=AdtTime
49
50 and AetAlertStatus=pending
51
52 and TheSystem.nextValueForAlertID.todtString().eq(AdtAlertID)
53
54 and ActAlert.init(AdtAlertID,
55     AetAlertStatus,
56     AdtGPSLocation,
57     AAlertInstant,
58     AdtComment)
59
60 /* PostF03 */
61 and TheSystem.rnctAlert.select(location.isNearTo(AdtGPSLocation)) = ColctAlertsNearBy
62 and if (ColctAlertsNearBy->size())=0
63 then (TheSystem.nextValueForCrisisID = PrenextValueForCrisisID
64     and PrenextValueForCrisisID.add(1) = PostnextValueForCrisisID
65     and TheSystem@post.nextValueForCrisisID = PostnextValueForCrisisID
66     and TheSystem.nextValueForCrisisID.todtString().eq(AdtCrisisID)
67     and AdtCrisisType = small
68     and AetCrisisStatus = pending
69     and ACrisisInstant= AAlertInstant
70     and ACrisisdtComment = 'no reporting yet defined'
71     and ActCrisis.init( AdtCrisisID,
72         AdtCrisisType,
73         AetCrisisStatus,
74         AdtGPSLocation,
75         ACrisisInstant,
76         ACrisisdtComment)
77 )
78 else (ColctAlertsNearBy.rnTheCrisis->msrAny(true) = ActCrisis)
79 endif
80
81 /* PostF04 */
82 and ActAlert@post.rnTheCrisis = ActCrisis
83
84 /* PostF05 */
85 and TheSystem.rnctHuman->select(id.eq(AdtPhoneNumber)) = HumanColl
86
87 and HumanColl->select(kind.etEq(AetHumanKind)) = HumanCol2
88 and if (HumanCol2->msrIsEmpty)
89 then (ActHuman.init(AdtPhoneNumber,AetHumanKind)
90     and ActHuman@post.rnactComCompany = TheactComCompany
91     )
92 else (HumanCol2->any(true) = ActHuman)
93 endif
94
95 and ActHuman.rnSignaled->msrIncluding(ActAlert) = ColAlerts
96
97 and ActHuman@post.rnSignaled = ColAlerts
98
99 /* PostF06 */
100 AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
101 and TheactComCompany.rnInterfaceIN^ieSmsSend(AdtPhoneNumber,AdtSMS)
102
103 /* Post Protocol:*/

```

```
104 postP{ true}
```

Listing 5.14: **Messir** (MCL-oriented) specification of the operation *oeAlert*.

The listing 5.15 provides the **Messir** (Prolog-oriented) implementation of the operation.

```
1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6nico(A):-
7 trace,
8 write('here'),
9 write('\n').
10
11msrop(outactComCompany,
12 oeAlert,
13 [preProtocol,Self,
14 AetHumanKind,
15 AdtDate,
16 AdtTime,
17 AdtPhoneNumber,
18 AdtGPSLocation,
19 AdtComment
20 ],
21 []):-
22/* Pre Protocol:*/
23 msrVar(ctState,TheSystem),
24 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
25/* PreP01 */
26 msrNav([TheSystem],
27 [vpStarted],
28 [[ptBoolean,true]]),
29 .
30
31msrop(outactComCompany,
32 oeAlert,
33 [preFunctional,Self,
34 AetHumanKind,
35 AdtDate,
36 AdtTime,
37 AdtPhoneNumber,
38 AdtGPSLocation,
39 AdtComment
40 ],
41 []):-
42/* Pre Functional:*/
43/* PreF01 */
44 msrVar(ctState,TheSystem),
45 msrNav([Self],
46 [msmAtPre,rnActor,rnSystem],
47 [TheSystem]),
48 (
49 ( msrNav([TheSystem],[clock,date,gt,[AdtDate]],[[ptBoolean,true]]))
50 ; (msrNav([TheSystem],[clock,date,eq,[AdtDate]],[[ptBoolean,true]]))
51 , msrNav([TheSystem],[clock,time,gt,[AdtTime]],[[ptBoolean,true]]))
52 )
53 .
54 .
55
56msrop(outactComCompany,
57 oeAlert,
58 [post,Self,
59 AetHumanKind,
60 AdtDate,
```

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```

61     AdtTime,
62     AdtPhoneNumber,
63     AdtGPSLocation,
64     AdtComment
65   ],
66   []):-  

67
68 msrVar(ctState,TheSystem),
69 msrVar(ctHuman,ActHuman),
70 msrVar(actComCompany,TheactComCompany),
71 msrVar(ctAlert,ActAlert),
72 msrVar(dtDateAndTime,AAlertInstant),
73 msrVar(etAlertStatus,AetAlertStatus),
74% msrVar(ctAlert,ActAlertNearBy),
75 msrVar(ctCrisis,ActCrisis),
76 msrVar(dtCrisisID,AdtCrisisID),
77% msrVar(etCrisisType,AetCrisisType),
78 msrVar(etCrisisStatus,AetCrisisStatus),
79 msrVar(dtDateAndTime,ACrisisInstant),
80 msrVar(dtComment,ACrisisdtComment),
81% msrVar(ptString,AptStringMessage),
82 msrVar(dtSMS,AdtSMS),
83 msrVar(dtAlertID,AdtAlertID),
84
85% msrVar(ptInteger,TheNextptIntegerValue),
86% msrVar(ptInteger,UpdatedNextptIntegerValue),
87% msrVar(inactComCompany,TheComCompanyIN),
88% msrVar(dtComment,TheCommentStored),
89% msrVar(dtString,TheCommentStoreddtString),
90
91/* Post Functional:*/
92
93 msrNav([Self],[rnActor],[TheactComCompany]),
94 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
95
96/* PostF01 */
97 msrNav([TheSystem],
98     [nextValueForAlertID],
99     [PrenextValueForAlertID]),
100 msrNav([PrenextValueForAlertID],
101     [add,[[dtInteger,[[value,[ptInteger,1]]],[],[]]],
102     [PostnextValueForAlertID]),
103 msrNav([TheSystem],
104     [msmAtPost,nextValueForAlertID],
105     [PostnextValueForAlertID]),
106
107 /* PostF02 */
108 msrNav([AAlertInstant],[date],[AdtDate]),
109 msrNav([AAlertInstant],[time],[AdtTime]),
110
111 msrNav([AetAlertStatus],
112     []),
113     [[etAlertStatus,pending]]),
114
115 msrNav([TheSystem],
116     [nextValueForAlertID,
117     todtString,[],eq,[AdtAlertID]],
118     [[ptBoolean,true]]),
119
120 msrNav([ActAlert],
121     [init,[AdtAlertID,
122         AetAlertStatus,
123         AdtGPSLocation,
124         AAlertInstant,
125         AdtComment]],
126     [[ptBoolean,true]]),
127
128 /* PostF03 */
129 msrNav([TheSystem],
130     [rnctAlert,
```

```

131     msrSelect,location,isNearTo,[AdtGPSLocation]],
132     ColctAlertsNearBy),
133
134 ( (msrNav(ColctAlertsNearBy,
135     [msrIsEmpty],
136     [[ptBoolean,true]]))
137 )
138 -> (
139     msrNav([TheSystem],
140         [nextValueForCrisisID],
141         [PrenextValueForCrisisID]),
142     msrNav([PrenextValueForCrisisID],
143         [add,[[dtInteger,[[value,[ptInteger,1]]],[],[]]]],
144         [PostnextValueForCrisisID]),
145     msrNav([TheSystem],
146         [msmAtPost,nextValueForCrisisID],
147         [PostnextValueForCrisisID]),
148
149     msrNav([TheSystem],
150         [nextValueForCrisisID,
151         todString,[],eq,[AdtCrisisID]],
152         [[ptBoolean,true]]),
153
154     msrNav([AdtCrisisType],[],[[etCrisisType,small]]),
155     msrNav([AetCrisisStatus],[],[[etCrisisStatus,pending]]),
156     msrNav([ACrisisInstant],[],[AAlerInstant]),
157     msrNav([ACrisisdtComment],
158         [value],
159         [[ptString,'no reporting yet defined']])),
160     msrNav([ActCrisis],[init,[AdtCrisisID,
161         AdtCrisisType,
162         AetCrisisStatus,
163         AdtGPSLocation,
164         ACrisisInstant,
165         ACrisisdtComment]],

166         [[ptBoolean,true]])

167 )
168 ;
169 ;
170     msrNav(ColctAlertsNearBy,
171         [rnTheCrisis,msrAny,msrTrue],
172         [ActCrisis])
173 ),
174 ),
175
176 /* PostF04 */
177
178 msrNav([ActAlert],
179     [msmAtPost,rnTheCrisis],
180     [ActCrisis]),
181
182/* PostF05 */
183
184 msrNav([TheSystem],
185     [rnctHuman,
186     msrSelect,id,eq,[AdtPhoneNumber]],
187     HumanColl),
188
189 msrNav(HumanColl,
190     [msrSelect,kind,etEq,[AetHumanKind]],
191     HumanCol2),
192
193 (msrNav(HumanCol2,[msrIsEmpty],[[ptBoolean,true]]))
194 -> (msrNav([ActHuman],
195     [init,[AdtPhoneNumber,AetHumanKind]],
196     [[ptBoolean,true]]),
197     msrNav([ActHuman],
198     [msmAtPost,rnactComCompany],
199     [TheactComCompany])
200 )

```

```

201 ; msrNav(HumanCol2,
202     [msrAny],
203     [ActHuman])
204 ),
205
206msrNav([ActHuman],
207     [rnSignaled,msrIncluding,[ActAlert]],
208     ColAlerts),
209
210msrNav([ActHuman],
211     [msmAtPost,rnSignaled],
212     ColAlerts),
213
214/* PostF06 */
215msrNav([AdtSMS],
216     [value],
217     [[ptString,'Your alert has been registered. We will handle it and keep you informed']])),
218msrNav([TheactComCompany],
219     [rnInterfaceIN,
220     ieSmsSend,[AdtPhoneNumber,
221         AdtSMS]],[[ptBoolean,true]]),
222
223/*
224
225 */
226
227 /* Post Protocol:*/
228/* PostP01 */
229 true
230 .

```

Listing 5.15: **Messir** (Prolog-oriented) implementation of the operation *oeAlert*.

Figure 5.2 shows concept model elements in the scope of the *oeAlert* operation

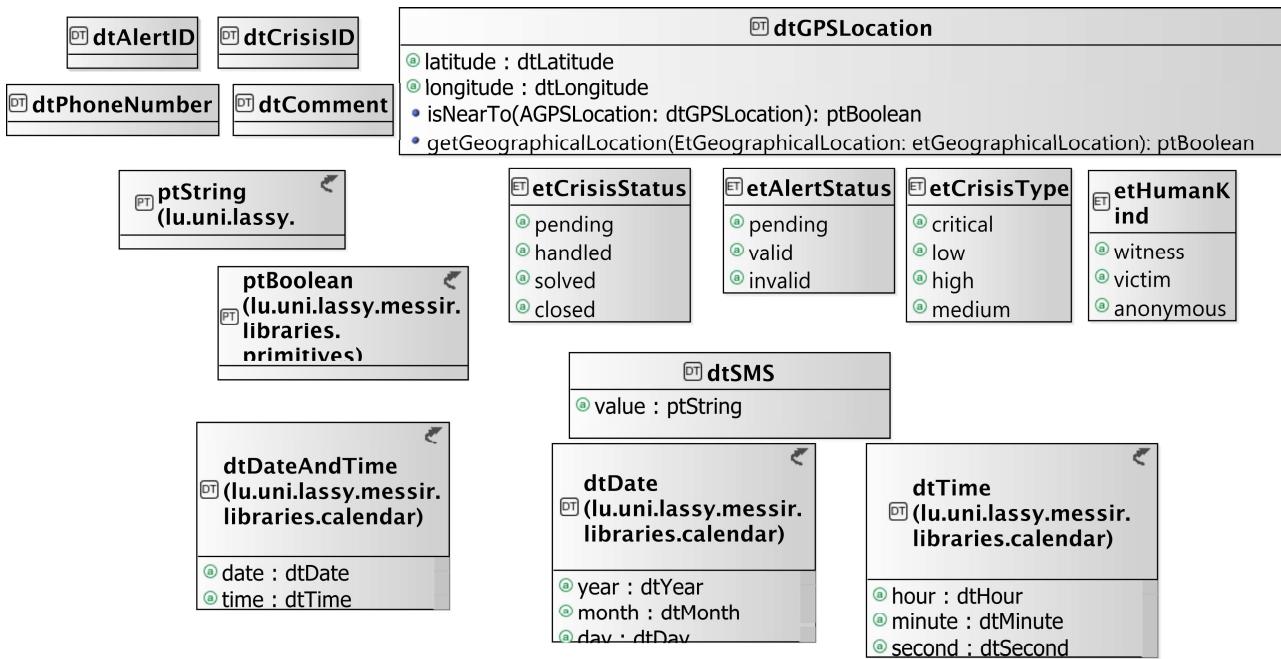


Figure 5.2: *oeAlert* operation scope

Figure 5.3 shows concept model elements in the scope of the *oeAlert* operation

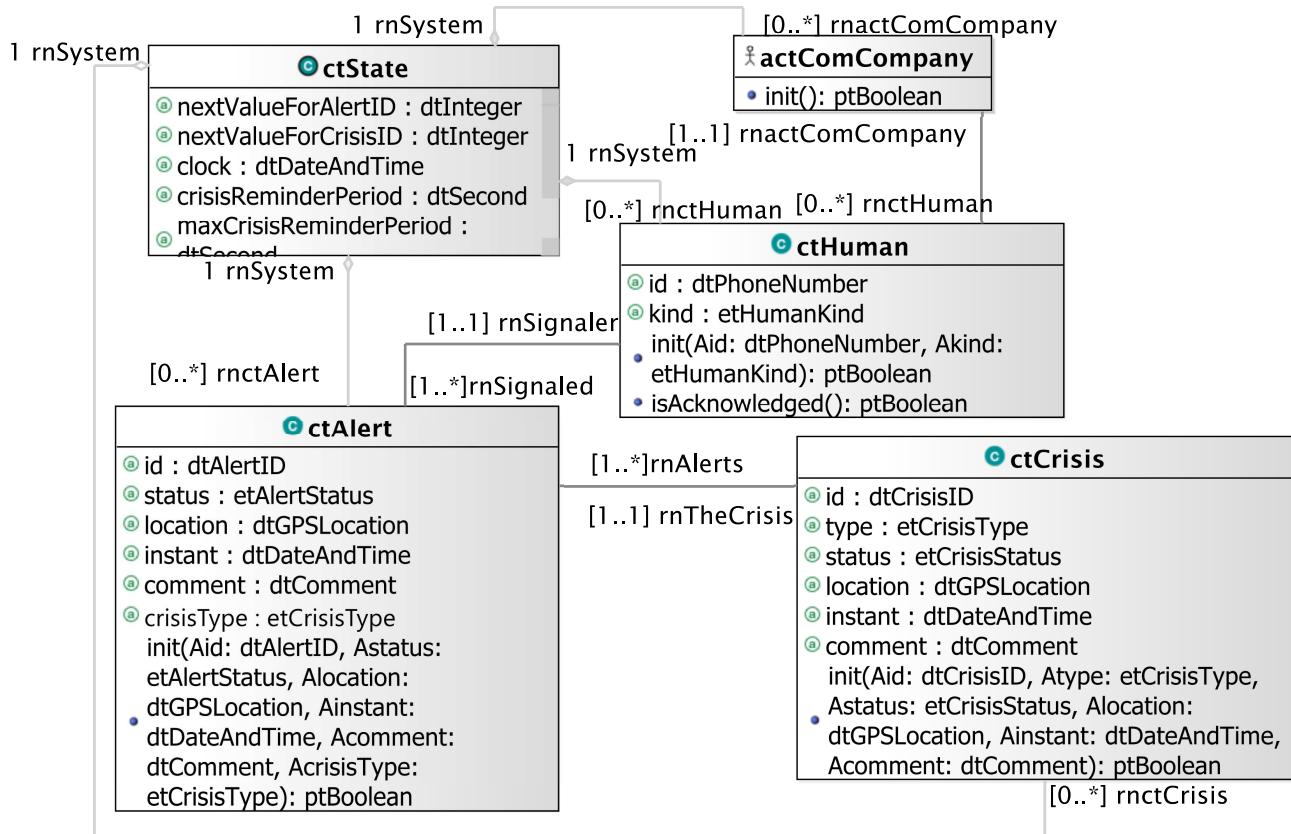


Figure 5.3: oeAlert operation scope

5.5 Environment - Out Interface Operation Scheme for actCoordinator

5.5.1 Operation Model for oeCloseCrisis

The oeCloseCrisis operation has the following properties:

| OPERATION | |
|--|---|
| <i>oeCloseCrisis</i> | |
| sent to indicate that a crisis should be considered as closed. | |
| <i>Parameters</i> | |
| 1 | AdtCrisisID: dtCrisisID the identification information used to determine the crisis to close |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Pre-Condition (protocol)</i> | |
| PreP 1 | the system is started |
| PreP 2 | the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |
| <i>Pre-Condition (functional)</i> | |
| PreF 1 | it is supposed that there exist one ctCrisis instance with the same id attribute value as the one provided by the coordinator actor who wants to close. |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | the ctCrisis class instance having the provided id is considered closed in the post state. |
| PostF 2 | There is no handler declared in the system as associated to the crisis. |
| PostF 3 | all the alert instances associated to this crisis do not belong any more to the system's post state. |
| PostF 4 | the coordinator actor is informed about the satisfaction of its request. |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | none |

The listing 5.16 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeCloseCrisis,
8    [preProtocol,Self,
9     AdtCrisisID
10    ],
11    []),
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],

```

```

20     [vpStarted],
21     [[ptBoolean,true]]) ,
22
23/* PreP02 */
24 msrNav([TheActor],
25   [rnctAuthenticated,vpIsLogged],
26   [[ptBoolean,true]])
27.
28
29msrop(outactCoordinator,
30   oeCloseCrisis,
31   [preFunctional,Self,
32   AdtCrisisID
33   ],
34   []):-!
35/* Pre Functional:*/
36 msrVar(ctState,TheSystem),
37 msrVar(actCoordinator,TheActor),
38
39 msrVar(dtCrisisID,AdtCrisisID),
40
41 msrNav([Self], [rnActor,rnSystem], [TheSystem]),
42 msrNav([Self], [rnActor], [TheActor]),
43
44/* PreF01 */
45 msrNav([TheSystem],
46   [rnctCrisis,
47   msrSelect,
48   id,eq,[AdtCrisisID]
49   ],
50   ColCrisis),
51
52 msrNav(ColCrisis,
53   [msrSize,eq,[[ptInteger,1]]],
54   [[ptBoolean,true]])
55 .
56
57msrop(outactCoordinator,
58   oeCloseCrisis,
59   [post,Self,
60   AdtCrisisID
61   ],
62   []):-!
63
64/* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actCoordinator,TheActor),
67
68 msrVar(ctCrisis,TheCrisis),
69 msrVar(dtCrisisID,AdtCrisisID),
70
71 msrNav([Self], [rnActor,rnSystem], [TheSystem]),
72 msrNav([Self], [rnActor], [TheActor]),
73
74/* PostF01 */
75 msrNav([TheSystem],
76   [rnctCrisis,
77   msrSelect,
78   id,eq,[AdtCrisisID]],
79   [TheCrisis]),
80
81 msrNav([TheCrisis],
82   [msmAtPost,status],
83   [[etCrisisStatus,closed]]),
84
85/* PostF02 */
86 msrNav([TheCrisis],
87   [msmAtPost,rnHandler],
88   []),
89

```

```

90 /* PostF03 */
91 msrNav([TheCrisis],
92     [rnAlerts,msrForAll,msrIsKilled],
93     [[ptBoolean,true]]),
94
95/* PostF04 */
96 msrNav([TheActor],
97     [rnInterfaceIN,
98      ieMessage,[[ptString,'The crisis is now closed !']]
99    ],
100   [[ptBoolean,true]]),
101
102/* Post Protocol:*/
103/* PostP01 */
104 true
105 .

```

Listing 5.16: **Messip** (Prolog-oriented) implementation of the operation *oeCloseCrisis*.

5.5.2 Operation Model for oeGetAlertsSet

The *oeGetAlertsSet* operation has the following properties:

| OPERATION |
|---|
| <i>oeGetAlertsSet</i> |
| sent to request all the ctAlert instances having a specific status, crisis Type and geographical location. |
| Parameters |
| 1 AetAlertStatus: etAlertStatus the criteria used to select the alerts to send back to the actor |
| Return type |
| ptBoolean |
| Pre-Condition (protocol) |
| PreP 1 the system is started PreP 2 the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |
| Pre-Condition (functional) |
| PreF 1 none |
| Post-Condition (functional) |
| PostF 1 the post state is the one obtained by satisfying the <i>isSentToCoordinator</i> predicate for each alert having the provided status,same crisis type and geographical location as ctCoordinator has, and for the actor sending the message. (cf. specification of <i>isSentToCoordinator</i> predicate given for the <i>ctAlert</i> type). |
| Post-Condition (protocol) |
| PostP 1 none |

The listing 5.17 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----

```

```

6msrop(outactCoordinator,
7    oeGetAlertsSet,
8    [preProtocol,Self,
9     AetAlertStatus
10    ],
11    []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]]))
26.
27
28msrop(outactCoordinator,
29    oeGetAlertsSet,
30    [preFunctional,Self,
31     AetAlertStatus
32    ],
33    []):-!
34/* Pre Functional:*/
35/* PreF01 */
36true
37.
38
39msrop(outactCoordinator,
40    oeGetAlertsSet,
41    [post,Self,
42     AetAlertStatus
43    ],
44    []):-!
45
46/* Post Functional:*/
47 msrVar(ctState,TheSystem),
48 msrVar(actCoordinator,TheActor),
49 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
50 msrNav([Self],[rnActor],[TheActor]),
51
52/* PostF01 */
53 msrNav([TheSystem],
54     [rnctAlert,
55      msrSelect,
56      status,etEq,[AetAlertStatus]],
57     ColAlertSet),
58
59 msrNav(ColAlertSet,
60     [msrForAll,isSentToCoordinator,[TheActor]],
61     [[ptBoolean,true]]),
62
63 /* Post Protocol:*/
64/* PostP01 */
65 true
66 .

```

Listing 5.17: **Messip** (Prolog-oriented) implementation of the operation *oeGetAlertsSet*.

5.5.3 Operation Model for *oeGetCrisisSet*

The *oeGetCrisisSet* operation has the following properties:

| OPERATION | |
|--|---|
| <i>oeGetCrisisSet</i> | |
| sent to request all the ctCrisis instances having a specific status, crisis type and geographical location | |
| Parameters | |
| 1 | AetCrisisStatus: etCrisisStatus the status information used to determine the crisis to send back to the actor |
| Return type | |
| ptBoolean | |
| Pre-Condition (protocol) | |
| PreP 1 | the system is started |
| PreP 2 | the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |
| Pre-Condition (functional) | |
| PreF 1 | none |
| Post-Condition (functional) | |
| PostF 1 | the post state is the one obtained by satisfying the <code>isSentToCoordinator</code> predicate for each crisis having the provided status, same crisis type and geographical location as ctCoordinator has, and for the actor sending the message <code>ieSendACrisis</code> . (cf. specification of <code>isSentToCoordinator</code> predicate given for the <code>ctCrisis</code> type.) |
| Post-Condition (protocol) | |
| PostP 1 | none |

The listing 5.18 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeGetCrisisSet,
8    [preProtocol,Self,
9     AetCrisisStatus
10    ],
11    []):- 
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24    [rnctAuthenticated,vpIsLogged],
25    [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29    oeGetCrisisSet,
30    [preFunctional,Self,
```

```

31     AetCrisisStatus
32     ],
33     []):- 
34 /* Pre Functional:*/
35 /* PreF01 */
36 true
37 .
38
39 msrop(outactCoordinator,
40   oeGetCrisisSet,
41   [post,Self,
42   AetCrisisStatus
43   ],
44   []):- 
45
46 /* Post Functional:*/
47 msrVar(ctState,TheSystem),
48 msrVar(actCoordinator,TheActor),
49 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
50 msrNav([Self],[rnActor],[TheActor]),
51
52 /* PostF01 */
53 msrNav([TheSystem],
54   [rnctCrisis,
55   msrSelect,
56   status,etEq,[AetCrisisStatus]],
57   ColCrisisSet),
58
59 msrNav(ColCrisisSet,
60   [msrForAll,isSentToCoordinator,[TheActor]],
61   [[ptBoolean,true]]),
62
63 /* Post Protocol:*/
64 /* PostP01 */
65 true
66 .

```

Listing 5.18: **Messip** (Prolog-oriented) implementation of the operation *oeGetCrisisSet*.

5.5.4 Operation Model for *oeInvalidateAlert*

The *oeInvalidateAlert* operation has the following properties:

| OPERATION |
|--|
| <i>oeInvalidateAlert</i> |
| sent to indicate that an alert should be considered as closed. |
| <i>Parameters</i> |
| 1 AdtAlertID: dtAlertID the identification information used to determine the alert to close |
| <i>Return type</i> |
| ptBoolean |
| <i>Pre-Condition (protocol)</i> |
| PreP 1 the system is started PreP 2 the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |
| <i>Pre-Condition (functional)</i> |
| PreF 1 it is supposed that there exist one ctAlert instance with the same id attribute value as the one provided by the coordinator actor who wants to close. |
| <i>Post-Condition (functional)</i> |

continues in next page ...

...Operation table continuation

| | |
|---|---|
| PostF 1 | the ctAlert class instance having the provided id is considered closed in the post state. |
| PostF 2 | the coordinator actor is informed about the satisfaction of its request. |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | none |

The listing 5.19 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeInvalidateAlert,
8    [preProtocol,Self,
9     AdtAlertID
10    ],
11    []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23/* PreP02 */
24 msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]]))
27.
28
29msrop(outactCoordinator,
30    oeInvalidateAlert,
31    [preFunctional,Self,
32     AdtAlertID
33    ],
34    []):-!
35/* Pre Functional:*/
36 msrVar(ctState,TheSystem),
37 msrVar(actCoordinator,TheActor),
38
39 msrVar(dtAlertID,AdtAlertID),
40
41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
42 msrNav([Self],[rnActor],[TheActor]),
43
44/* PreF01 */
45 msrNav([TheSystem],
46     [rnctAlert,
47      msrSelect,
48      id,eq,[AdtAlertID]
49    ],
50    ColAlert),
51
52 msrNav(ColAlert,
53     [msrSize,eq,[[ptInteger,1]]],
54     [[ptBoolean,true]])
55 .

```

```

56
57 msrop(outactCoordinator,
58   oeInvalidateAlert,
59   [post, Self,
60    AdtAlertID
61   ],
62   []):-  

63
64 /* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actCoordinator,TheActor),
67
68 msrVar(ctAlert,TheAlert),
69 msrVar(dtAlertID,AdtAlertID),
70
71 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
72 msrNav([Self], [rnActor], [TheActor]),
73
74 /* PostF01 */
75 msrNav([TheSystem],
76   [rnctAlert,
77    msrSelect,
78    id, eq, [AdtAlertID]],
79   [TheAlert]),
80
81 msrNav([TheAlert],
82   [msmAtPost, status],
83   [[etAlertStatus, invalid]]),
84
85 /* PostF02 */
86 msrNav([TheActor],
87   [rnInterfaceIN,
88    ieMessage, [[ptString, 'The alert is now declared as invalid !']]  

89   ],
90   [[ptBoolean, true]]),
91
92 /* Post Protocol:*/
93 /* PostP01 */
94 true
95 .

```

Listing 5.19: **Messir** (Prolog-oriented) implementation of the operation *oeInvalidateAlert*.

5.5.5 Operation Model for *oeReportOnCrisis*

The *oeReportOnCrisis* operation has the following properties:

| OPERATION | |
|---|---|
| <i>oeReportOnCrisis</i> | |
| sent to update the textual information available for a specific handled crisis. | |
| <i>Parameters</i> | |
| 1 | AdtCrisisID: dtCrisisID the identification information used to determine the crisis to report on |
| 2 | AdtComment: dtComment the textual information commenting the crisis |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Pre-Condition (protocol)</i> | |
| PreP 1 | the system is started |
| PreP 2 | the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |

continues in next page ...

... Operation table continuation

| <i>Pre-Condition (functional)</i> | |
|--|--|
| PreF 1 it is supposed that there exist one crisis in the pre state having the given id. | |
| <i>Post-Condition (functional)</i> | |
| PostF 1 the comment attribute of the crisis instance having the given id is replaced by the given one and the requesting actor is notified of this update. | |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 none | |

The listing 5.20 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeReportOnCrisis,
8    [preProtocol,Self,
9     AdtCrisisID,
10    AdtComment
11    ],
12   []):-!
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actCoordinator,TheActor),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheActor]),
18
19/* PreP01 */
20 msrNav([TheSystem],
21        [vpStarted],
22        [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25        [rnctAuthenticated,vpIsLogged],
26        [[ptBoolean,true]])
27.
28
29msrop(outactCoordinator,
30    oeReportOnCrisis,
31    [preFunctional,Self,
32     AdtCrisisID,
33     AdtComment
34     ],
35   []):-!
36/* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45/* PreF01 */
46 msrNav([TheSystem],
47        [rnctCrisis,
48         msrSelect,
49         id,eq,[AdtCrisisID]
50        ],
51        ColCrisis),

```

```

52
53 msrNav(ColCrisis,
54     [msrSize, eq, [[ptInteger, 1]]],
55     [[ptBoolean, true]])
56 .
57
58 msrop(outactCoordinator,
59 oeReportOnCrisis,
60 [post, Self,
61 AdtCrisisID,
62 AdtComment
63 ],
64 []):-.
65
66 /* Post Functional:*/
67 msrVar(ctState, TheSystem),
68 msrVar(actCoordinator, TheActor),
69
70 msrVar(ctCrisis, TheCrisis),
71 msrVar(dtCrisisID, AdtCrisisID),
72 msrVar(dtComment, AdtComment),
73
74 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
75 msrNav([Self], [rnActor], [TheActor]),
76
77 /* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80      msrSelect,
81      id, eq, [AdtCrisisID]],
82     [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost, comment],
86     [AdtComment]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90      ieMessage, [[ptString, 'The crisis comment has been updated !']]],
91     [ [ptBoolean, true]]),
92
93
94 /* Post Protocol:*/
95 /* PostP01 */
96 true
97 .

```

Listing 5.20: **Messir** (Prolog-oriented) implementation of the operation *oeReportOnCrisis*.

5.5.6 Operation Model for *oeSetCrisisHandler*

The *oeSetCrisisHandler* operation has the following properties:

| OPERATION | |
|--|---|
| <i>oeSetCrisisHandler</i> | |
| sent to declare himself as been the handler of a crisis having the specified id. | |
| Parameters | |
| 1 | AdtCrisisID: dtCrisisID the identification information used to determine the crisis |
| Return type | |
| ptBoolean | |
| Pre-Condition (protocol) | |
| <i>continues in next page ...</i> | |

...Operation table continuation

| | |
|---|--|
| PreP 1 | the system is started |
| PreP 2 | the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |
| <i>Pre-Condition (functional)</i> | |
| PreF 1 | there exist one crisis having the given id in the pre-state. |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | the ctCrisis instance having the provided id is in handled status at poststate and is associated to the actor that sends the message (which himself is notified with a textual message as confirmation). |
| PostF 2 | All the alerts related to this crisis are sent to the actor such that he can decide how to handle them. |
| PostF 3 | if the crisis was already handled at pre-state then the associated handler actor is notified about the change of handler for one of his crisis (n.b. it might be the same even if not relevant). |
| PostF 4 | a message is sent to the communication company for any human related to an alert associated to the crisis. A human will receive as many messages as alerts he sent despite the fact that they might relate to the same crisis (i.e. one alert, one acknowledgement). |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | none |

The listing 5.21 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeSetCrisisHandler,
8    [preProtocol,Self,
9     AdtCrisisID
10    ],
11    []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24    [rnctAuthenticated,vpIsLogged],
25    [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29    oeSetCrisisHandler,
30    [preFunctional,Self,
31     AdtCrisisID
32    ],
33    []):-

```

```

34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actCoordinator,TheActor),
37
38 msrVar(dtCrisisID,AdtCrisisID),
39
40 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
41 msrNav([Self],[rnActor],[TheActor]),
42
43/* PreF01 */
44 msrNav([TheSystem],
45     [rnctCrisis,
46      msrSelect,
47      id,eq,[AdtCrisisID]
48    ],
49    ColCrisis),
50
51 msrNav(ColCrisis,
52     [msrSize,eq,[[ptInteger,1]]],
53     [[ptBoolean,true]])
54 .
55
56msrop(outactCoordinator,
57 oeSetCrisisHandler,
58 [post,Self,
59 AdtCrisisID
60 ],
61 []):-.
62
63/* Post Functional:*/
64 msrVar(ctState,TheSystem),
65 msrVar(actCoordinator,TheActor),
66 msrVar(ctCoordinator,TheCoordinator),
67 msrVar(ctCoordinator,TheCurrentHandler),
68
69 msrVar(ctCrisis,TheCrisis),
70 msrVar(dtCrisisID,AdtCrisisID),
71
72 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
73 msrNav([Self],[rnActor],[TheActor]),
74
75/* PostF01 */
76 msrNav([TheSystem],
77     [rnctCrisis,
78      msrSelect,
79      id,eq,[AdtCrisisID]],
80     [TheCrisis]),
81
82 msrNav([TheCrisis],
83     [msmAtPost,status],
84     [[etCrisisStatus,handled]]),
85
86 msrNav([TheActor],
87     [rnctCoordinator],
88     [TheCoordinator]),
89 msrNav([TheCrisis],
90     [msmAtPost,rnHandler],
91     [TheCoordinator]),
92
93 msrNav([TheActor],
94     [rnInterfaceIN,
95      ieMessage,[[ptString,'You are now considered as handling the crisis !']]
96    ],
97     [[ptBoolean,true]]),
98
99 /* PostF02 */
100 msrNav([TheCrisis],
101     [rnAlerts,msrForAll,isSentToCoordinator,[TheActor]],
102     [[ptBoolean,true]]),
103

```

```

104  /* PostF03 */
105  ( msrNav([TheCrisis],
106    [rnHandler,msrSize,eq,[[ptInteger,1]]],
107    [[ptBoolean,true]])
108  -> (msrNav([TheCrisis],
109    [rnHandler],
110    [TheCurrentHandler]),
111    msrNav([TheCurrentHandler],
112    [rnactCoordinator,rnInterfaceIN,
113    ieMessage,[[ptString,'One of the crisis you were handling is now handled by one of your
114    colleagues!']]])
115    ],
116    [[ptBoolean,true]])
117  ;
118  ),
119
120  /* PostF04 */
121  msrNav([TheCrisis],
122    [rnAlerts,rnSignaler,msrForAll,isAcknowledged,[],,
123    [[ptBoolean,true]]],
124
125  /* Post Protocol:*/
126/* PostP01 */
127 true
128 .

```

Listing 5.21: **Messip** (Prolog-oriented) implementation of the operation *oeSetCrisisHandler*.

5.5.7 Operation Model for oeSetCrisisStatus

The *oeSetCrisisStatus* operation has the following properties:

| OPERATION |
|---|
| <i>oeSetCrisisStatus</i> |
| sent to define the handling status of a specific crisis. |
| Parameters |
| 1 AdtCrisisID: dtCrisisID the identification information used to determine the crisis |
| 2 AetCrisisStatus: etCrisisStatus the new status value |
| Return type |
| ptBoolean |
| Pre-Condition (protocol) |
| PreP 1 the system is started |
| PreP 2 the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |
| Pre-Condition (functional) |
| PreF 1 it is supposed that there exist one crisis in the pre state having the given id. |
| Post-Condition (functional) |
| PostF 1 the crisis status attribute of the crisis instance having the given id is replaced by the given one and the requesting actor is notified of this update. |
| Post-Condition (protocol) |
| PostP 1 none |

The listing 5.22 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeSetCrisisStatus,
8    [preProtocol,Self,
9     AdtCrisisID,
10    AetCrisisStatus
11   ],
12   []):-!
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actCoordinator,TheActor),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheActor]),
18
19/* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]]),
27.
28
29msrop(outactCoordinator,
30    oeSetCrisisStatus,
31    [preFunctional,Self,
32     AdtCrisisID,
33     AetCrisisStatus
34   ],
35   []):-!
36/* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45/* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,
48      msrSelect,
49      id,eq,[AdtCrisisID]
50   ],
51   ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize,eq,[[ptInteger,1]]],
55     [[ptBoolean,true]]),
56 .
57
58msrop(outactCoordinator,
59    oeSetCrisisStatus,
60    [post,Self,
61     AdtCrisisID,
62     AetCrisisStatus
63   ],
64   []):-!
65
66/* Post Functional:*/
67 msrVar(ctState,TheSystem),

```

```

68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(etCrisisStatus,AetCrisisStatus),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77/* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80      msrSelect,
81      id,eq,[AdtCrisisID]],
82     [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,status],
86     [AetCrisisStatus]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90      ieMessage,[[ptString,'The crisis status has been updated !']]
91     ],
92     [[ptBoolean,true]]),
93
94/* Post Protocol:*/
95/* PostP01 */
96 true
97 .

```

Listing 5.22: **Messip** (Prolog-oriented) implementation of the operation *oeSetCrisisStatus*.

5.5.8 Operation Model for *oeSetCrisisType*

The *oeSetCrisisType* operation has the following properties:

| OPERATION | |
|--|--|
| <i>oeSetCrisisType</i> | |
| sent to define the gravity type of a specific crisis and alert which is associated with this crisis. | |
| Parameters | |
| 1 | AdtCrisisID: dtCrisisID the identification information used to determine the crisis |
| 2 | AetCrisisType: etCrisisType the new type value |
| Return type | |
| ptBoolean | |
| Pre-Condition (protocol) | |
| PreP 1 | the system is started |
| PreP 2 | the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |
| Pre-Condition (functional) | |
| PreF 1 | it is supposed that there exist one crisis in the pre state having the given id. |
| Post-Condition (functional) | |
| PostF 1 | the crisis type attribute of the crisis instance having the given id is replaced by the given one. the crisis type attribute of the alert insanse that is associated with current crisis is replaced by the given one. the requesting actor is notified of this update. |

continues in next page ...

... Operation table continuation

| <i>Post-Condition (protocol)</i> |
|----------------------------------|
| PostP 1 none |

The listing 5.23 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeSetCrisisType,
8    [preProtocol,Self,
9     AdtCrisisID,
10    AetCrisisType
11   ],
12  []):-!
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actCoordinator,TheActor),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheActor]),
18
19/* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]]),
27.
28
29msrop(outactCoordinator,
30    oeSetCrisisType,
31    [preFunctional,Self,
32     AdtCrisisID,
33     AetCrisisType
34   ],
35  []):-!
36/* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45/* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,
48      msrSelect,
49      id,eq,[AdtCrisisID]
50   ],
51     ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize,eq,[[ptInteger,1]]],
55     [[ptBoolean,true]]),
56.
57
58msrop(outactCoordinator,
```

```

59 oeSetCrisisType,
60 [post,Self,
61   AdtCrisisID,
62   AetCrisisType
63 ],
64 []):-  

65
66/* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(etCrisisType,AetCrisisType),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77/* PostF01 */
78 msrNav([TheSystem],
79   [rnctCrisis,
80    msrSelect,
81    id,eq,[AdtCrisisID]],
82   [TheCrisis]),
83
84 msrNav([TheCrisis],
85   [msmAtPost,type],
86   [AetCrisisType]),
87
88 msrNav([TheActor],
89   [rnInterfaceIN,
90    ieMessage,[[ptString,'The crisis type has been updated !']],
91    ],
92   [[ptBoolean,true]]),
93
94/* Post Protocol:*/
95/* PostP01 */
96 true
97 .

```

Listing 5.23: **Messir** (Prolog-oriented) implementation of the operation *oeSetCrisisType*.

5.5.9 Operation Model for *oeValidateAlert*

The *oeValidateAlert* operation has the following properties:

| OPERATION |
|--|
| <i>oeValidateAlert</i> |
| sent to indicate that a specific alert is not a fake. |
| Parameters |
| 1 AdtAlertID: dtAlertID the identification information used to determine the alert instance |
| Return type |
| ptBoolean |
| Pre-Condition (protocol) |
| PreP 1 the system is started PreP 2 the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged) |
| Pre-Condition (functional) |

continues in next page ...

... Operation table continuation

| | |
|---|---|
| PreF 1 | it is supposed that there exist one ctAlert instance with the same id attribute value as the one provided by the coordinator actor who wants to validate. |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | the ctAlert class instance having the provided id is considered as valid in the post state and the coordinator actor is informed about the satisfaction of its request. |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | none |

The listing 5.24 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeValidateAlert,
8    [preProtocol,Self,
9     AdtAlertID
10    ],
11    []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]]))
26.
27
28msrop(outactCoordinator,
29    oeValidateAlert,
30    [preFunctional,Self,
31     AdtAlertID
32    ],
33    []):-!
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actCoordinator,TheActor),
37
38 msrVar(dtAlertID,AdtAlertID),
39
40 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
41 msrNav([Self],[rnActor],[TheActor]),
42
43/* PreF01 */
44 msrNav([TheSystem],
45     [rnctAlert,
46      msrSelect,
47      id,eq,[AdtAlertID]
48    ],
49    ColAlerts),
50
51 msrNav(ColAlerts,
```

```

52     [msrSize, eq, [[ptInteger, 1]]],  

53     [[ptBoolean, true]])  

54 .  

55  

56msrop(outactCoordinator,  

57    oeValidateAlert,  

58    [post, Self,  

59     AdtAlertID  

60     ],  

61     []):-  

62  

63/* Post Functional:*/  

64 msrVar(ctState, TheSystem),  

65 msrVar(actCoordinator, TheActor),  

66  

67 msrVar(ctAlert, TheAlert),  

68 msrVar(dtAlertID, AdtAlertID),  

69  

70 msrNav([Self], [rnActor, rnSystem], [TheSystem]),  

71 msrNav([Self], [rnActor], [TheActor]),  

72  

73/* PostF01 */  

74 msrNav([TheSystem],  

75   [rnctAlert,  

76    msrSelect,  

77    id, eq, [AdtAlertID]],  

78   [TheAlert]),  

79  

80 msrNav([TheAlert],  

81   [msmAtPost, status],  

82   [[etAlertStatus, valid]]),  

83  

84 msrNav([TheActor],  

85   [rnInterfaceIN,  

86    ieMessage, [[ptString, 'The Alert is now declared as valid !']]  

87    ],  

88   [[ptBoolean, true]]),  

89  

90 /* Post Protocol:*/  

91/* PostP01 */  

92 true  

93 .

```

Listing 5.24: **Messip** (Prolog-oriented) implementation of the operation *oeValidateAlert*.

5.6 Environment - Out Interface Operation Scheme for actMsrCreator

5.6.1 Operation Model for oeCreateSystemAndEnvironment

The *oeCreateSystemAndEnvironment* operation has the following properties:

| OPERATION |
|--|
| <i>oeCreateSystemAndEnvironment</i> |
| sent to request the initialization of the system's class instances and the environment actors instances. |
| <i>Parameters</i> |
| 1 AqtyComCompanies: ptInteger the quantity of communication companies to create in the environment |
| <i>Return type</i> |
| ptBoolean |
| <i>Pre-Condition (protocol)</i> |

continues in next page ...

... Operation table continuation

| | |
|------------------------------------|--|
| PreP 1 | none |
| <i>Pre-Condition (functional)</i> | |
| PreF 1 | none |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | the ctState instance is initialized with the integer 1 for the crisis and alert counters used for their identifications, a value for the clock corresponding to a default initial time (i.e. January 1st, 1970) the crisis reminder period is set to 300 seconds, the maximum crisis reminder period is fixed to 1200 seconds (i.e. 20 minutes), an initial value for the automatic reminder period equal to the current date and time and the system is considered in a started state. Those predicates must be satisfied first since all the other depend on the existence of a ctState instance ! |
| PostF 2 | the actMsrCreator actor instance is initiated (remember that since the oeCreateSystemAndEnvironment is a special event its role is to make consistent the post state thus creating the actor and its interfaces is required even though the sending of this message logically would need the actor and its interfaces to already exist ...). |
| PostF 3 | the environment for communication company actors, in the post state, is made of AqtyComCompanies instances allowing for receiving and sending messages to humans. |
| PostF 4 | the environment for administrator actors, in the post state, is made of one instance. |
| PostF 5 | the environment for activator actors, in the post state, is made of one instance allowing for automatic message sending based on current system's and environment state'. |
| PostF 6 | the set of ctAdministrator instances at post is made of one instance initialized with 'icrashadmin' (resp. '7WXC1359') for login (resp. password) values. |
| PostF 7 | the association between ctAdministrator and actAdministrator is made of one couple made of the conjointly specified instances. |
| <i>Post-Condition (protocol)</i> | |
| PostP 1 | none is given since the only protocol variable to be modified in the post state is the one initialized with the ctState instance (i.e. vpStarted). |

The listing 5.25 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol:*/
2  preP{true}
3
4
5  /* Pre Functional:*/
6  preF{true}
7
8  /* Post Functional:*/
9  postF{let TheSystem: ctState in
10   let AactMsrCreator: actMsrCreator in
11   let AactAdministrator: actAdministrator in
12   let AnextValueForAlertID: dtInteger in
13   let AnextValueForCrisisID: dtInteger in
14   let Aclock: dtDateAndTime in
15   let AcrisisReminderPeriod: dtSecond in
16   let AmaxCrisisReminderPeriod: dtSecond in
17   let AvpStarted: ptBoolean in
18
19  /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
20  AnextValueForAlertID.value.eq(1)
21  and AnextValueForCrisisID.value.eq(1)
22  and Aclock.date.year.value = 1970

```

```

23  and Aclock.date.month.value = 01
24  and Aclock.date.day.value = 01
25  and Aclock.time.hour.value = 00
26  and Aclock.time.minute.value = 00
27  and Aclock.time.second.value = 00
28
29  and AcrisisReminderPeriod.value.eq(300)
30  and AmaxCrisisReminderPeriod.value.eq(1200)
31  and AvpStarted = true
32  and TheSystem.init(AnextValueForAlertID,
33      AnextValueForCrisisID,
34      Aclock,
35      AcrisisReminderPeriod,
36      AmaxCrisisReminderPeriod,
37      Aclock,
38      AvpStarted
39      )
40  /* PostF02*/
41  and AactMsrCreator.init()
42  /* PostF03 */
43  and let AactComCompanyCol: Bag(actComCompany) in
44  AactComCompanyCol->size() = AqtyComCompanies
45  AactComCompanyCol-> forall(init())
46  /* PostF04*/
47  and AactAdministrator.init()
48  /* PostF05*/
49  and let AactActivator:actActivator in
50  AactActivator.init()
51  /* PostF06 */
52  and let ActAdministrator:ctAdministrator in
53  let AdtLogin:dtLogin in
54  let AdtPassword:dtPassword in
55  AdtLogin.value.eq('icrashadmin')
56  and AdtPassword.value.eq('7WXC1359')
57  and ActAdministrator.init(AdtLogin,AdtPassword)
58  /* PostF07*/
59  and ActAdministrator@post.rnactAuthenticated = AactAdministrator}
60
61 /* Post Protocol:*/
62 postP{ true}

```

Listing 5.25: **Messip** (MCL-oriented) specification of the operation *oeCreateSystemAndEnvironment*.

The listing 5.26 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5/*
6*****MSRCreatorActor*****
7MSRCreatorActor
8*****MSRCreatorActor*****
9
10/** createSystemAndEnvironment ***/
11
12msrop(outactMsrCreator,
13    oeCreateSystemAndEnvironment,
14    [prefunctional,_Self,_AqtyComCompanies],
15    []):-[]
16 true.
17
18msrop(outactMsrCreator,
19    oeCreateSystemAndEnvironment,
20    [preProtocol,_Self,_AqtyComCompanies],

```

```

21      []):-  

22  true.  

23  

24msrop(outactMsrCreator,  

25     oeCreateSystemAndEnvironment,  

26     [post,_Self,AqtyComCompanies],  

27     []):-  

28  

29 msrVar(ctState,TheSystem),  

30 msrVar(actMsrCreator,AactMsrCreator),  

31 msrVar(actAdministrator,AactAdministrator),  

32  

33 msrVar(dtInteger, AnextValueForAlertID),  

34 msrVar(dtInteger, AnextValueForCrisisID),  

35 msrVar(dtDateAndTime, Aclock),  

36 msrVar(dtSecond, AcrisisReminderPeriod),  

37 msrVar(dtSecond, AmaxCrisisReminderPeriod),  

38 msrVar(ptBoolean, AvpStarted),  

39  

40 /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */  

41 msrNav([AnextValueForAlertID],  

42         [value,eq,[[ptInteger,1]]],  

43         [[ptBoolean,true]]),  

44  

45 msrNav([AnextValueForCrisisID],  

46         [value,eq,[[ptInteger,1]]],  

47         [[ptBoolean,true]]),  

48  

49msrNav([Aclock],  

50         [date,year,value],  

51         [[ptInteger,1970]]),  

52msrNav([Aclock],  

53         [date,month,value],  

54         [[ptInteger,01]]),  

55msrNav([Aclock],  

56         [date,day,value],  

57         [[ptInteger,01]]),  

58  

59msrNav([Aclock],  

60         [time,hour,value],  

61         [[ptInteger,00]]),  

62msrNav([Aclock],  

63         [time,minute,value],  

64         [[ptInteger,00]]),  

65msrNav([Aclock],  

66         [time,second,value],  

67         [[ptInteger,00]]),  

68  

69 msrNav([AcrisisReminderPeriod],  

70         [value,eq,[[ptInteger,300]]],  

71         [[ptBoolean,true]]),  

72  

73 msrNav([AmaxCrisisReminderPeriod],  

74         [value,eq,[[ptInteger,1200]]],  

75         [[ptBoolean,true]]),  

76  

77 msrNav([AvpStarted],  

78         [],  

79         [[ptBoolean,true]]),  

80  

81 msrNav([TheSystem],  

82         [init,[AnextValueForAlertID,  

83             AnextValueForCrisisID,  

84             Aclock,  

85             AcrisisReminderPeriod,  

86             AmaxCrisisReminderPeriod,  

87             Aclock,  

88             AvpStarted]  

89             ],  

90         [[ptBoolean,true]]),

```

```

91
92/* PostF02*/
93 msrNav([AactMsrCreator],
94     [init, []],
95     [[ptBoolean,true]]),
96
97 /* PostF03 */
98 msrVarCol(actComCompany,AqtyComCompanies,AactComCompanyCol),
99
100 msrNav(AactComCompanyCol,
101     [msrForAll,init, []],
102     [[ptBoolean,true]]),
103
104 /* PostF04*/
105 msrNav([AactAdministrator],
106     [init, []],
107     [[ptBoolean,true]]),
108
109 /* PostF05*/
110 msrVar(actActivator,AactActivator),
111 msrNav([AactActivator],
112     [init, []],
113     [[ptBoolean,true]]),
114
115/* PostF06 */
116 msrVar(ctAdministrator,ActAdministrator),
117 msrVar(dtLogin,AdtLogin),
118 msrVar(dtPassword,AdtPassword),
119
120 msrNav([AdtLogin],
121     [value,eq,[[ptString,'icrashadmin']]],
122     [[ptBoolean,true]]),
123
124 msrNav([AdtPassword],
125     [value,eq,[[ptString,'7WXC1359']]],
126     [[ptBoolean,true]]),
127
128 msrNav([ActAdministrator],
129     [init,[AdtLogin,AdtPassword]],
130     [[ptBoolean,true]]),
131
132 /* PostF07*/
133 msrNav([ActAdministrator],
134     [msmAtPost,rnactAuthenticated],
135     [AactAdministrator]),
136
137/* Post Protocol:*/
138/* PostP01 */
139true
140.

```

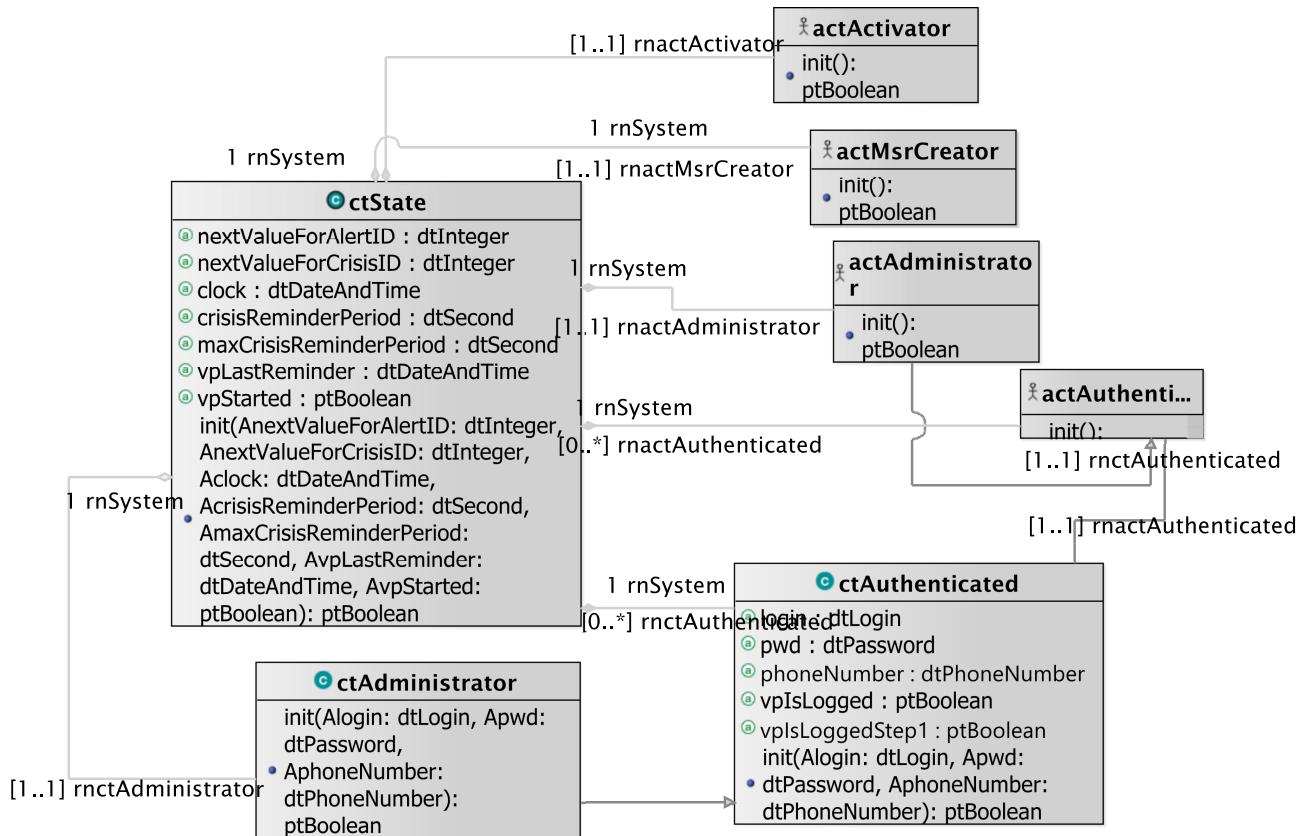
Listing 5.26: **Messip** (Prolog-oriented) implementation of the operation *oeCreateSystemAndEnvironment*.

Figure 5.4 shows all the concept model elements in the scope of the *oeCreateSystemAndEnvironment* operation

5.7 Environment - Actor Operation Scheme for actMsrCreator

5.7.1 Operation Model for init

The *init* operation has the following properties:

Figure 5.4: `oeCreateSystemAndEnvironment` operation scope

| OPERATION |
|---|
| <i>init</i> |
| used to create an instance of the actor together with its interface instances and update the associations with the <code>ctState</code> instance. |
| <i>Return type</i> |
| <code>ptBoolean</code> |

5.8 Primary Types - Operation Schemes for Class ctAdministrator

5.8.1 Operation Model for *init*

The `init` operation has the following properties:

| OPERATION |
|--|
| <i>init</i> |
| used to initialize the current object as a new instance of the <code>ctAdministrator</code> type. |
| <i>Parameters</i> |
| 1 Alogin: dtLogin used to initialize the login field 2 Apwd: dtPassword used to initialize the password field 3 AphoneNumber: dtPhoneNumber used to initialize the phone numberfield |
| <i>Return type</i> |
| <code>ptBoolean</code> |
| <i>Post-Condition (functional)</i> |
| PostF 1 true iff the system poststate includes the current object as a new <code>ctAdministrator</code> instance having its login and password attributes equal to the one provided as parameters and its <code>vpIsLogged</code> attribute equal to false. |

The listing 5.27 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2  /* Post Functional:*/
3  postF{if
4  (
5  let Self:ctAdministrator in
6  /* Post F01 */
7  Self.login(Alogin)
8  and Self.pwd = Apwd
9  and Self.phoneNumber = AphoneNumber
10 and Self.vpIsLogged = false
11
12 /* Post F02 */
13 and (Self.oclIsNew and self = Self)
14 )
15 then (result = true)
16 else (result = false)
17 endif}

```

Listing 5.27: **Messip** (MCL-oriented) specification of the operation *init*.

The listing 5.28 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctAdministrator, init, [Self,
7      Alogin,
8      Apwd],
9      Result):-
10(
11msrVar(ctAdministrator, Self),
12
13/* Post F01 */
14msrNav([Self], [login], [Alogin]),
15msrNav([Self], [pwd], [Apwd]),
16msrNav([Self], [vpIsLogged], [[ptBoolean, false]]),
17
18/* Post F02 */
19 msrNav([Self], [msrIsNew], [Self])
20)
21-> Result = [ptBoolean, true]
22; Result = [ptBoolean, false]
23.

```

Listing 5.28: **Messir** (Prolog-oriented) implementation of the operation *init*.

5.9 Primary Types - Operation Schemes for Class ctAlert

5.9.1 Operation Model for *init*

The *init* operation has the following properties:

| OPERATION | |
|--|---|
| <i>init</i> | |
| used to initialize the current object as a new instance of the ctAlert type. | |
| Parameters | |
| 1 | Aid: dtAlertID used to initialize the id field |
| 2 | Astatus: etAlertStatus used to initialize the status field |
| 3 | Alocation: dtGPSLocation used to initialize the location field |
| 4 | Ainstant: dtDateAndTime used to initialize the instant field |
| 5 | Acomment: dtComment used to initialize the comment field |
| 6 | AcrisisType: etCrisisType used to initialize the type of the crisis |
| Return type | |
| ptBoolean | |
| Post-Condition (functional) | |
| PostF 1 | true iff the system poststate includes the current object as a new ctAlert instance having its attributes equal to the ones provided as parameters. |

The listing 5.29 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{if
3  (
4  /* Post F01 */
5  let Self:ctAlert in
6  Self.id = Aid
7  and Self.status = Astatus
8  and Self.location = Alocation
9  and Self.instant = Ainstant
10 and Self.comment = Acomment
11 and Self.crisisType = AcrisisType
12 and Self.ocrIsNew = Self)
13 /* Post F02 */
14 and (Self.ocrIsNew and self = Self)
15 )
16 then (result = true)
17 else (result = false)
18 endif}

```

Listing 5.29: **Messip** (MCL-oriented) specification of the operation *init*.

The listing 5.30 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctAlert, init, [Self,
7          Aid,
8          Astatus,
9          Alocation,
10         Ainstant,
11         Acomment],
12        Result):-!
13
14/* Post F01 */
15(
16msrVar(ctAlert, Self),
17
18msrNav([Self], [id], [Aid]),
19msrNav([Self], [status], [Astatus]),
20msrNav([Self], [location], [Alocation]),
21msrNav([Self], [instant], [Ainstant]),
22msrNav([Self], [comment], [Acomment]),
23
24/* Post F02 */
25 msrNav([Self], [msrIsNew], [Self])
26)
27-> Result = [ptBoolean,true]
28; Result = [ptBoolean,false]
29.

```

Listing 5.30: **Messip** (Prolog-oriented) implementation of the operation *init*.

5.9.2 Operation Model for isSentToCoordinator

The `isSentToCoordinator` operation has the following properties:

| OPERATION | |
|---|---|
| <i>isSentToCoordinator</i> | |
| used to provide a given coordinator with current alert information. | |
| <i>Parameters</i> | |
| 1 | AactCoordinator: actCoordinator the message destination |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | true iff the message ieSendAnAlert is sent to the input interface of the given coordinator actor with the current alert as parameter value. |

The listing 5.31 provides the **Messir** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{if
3  (
4  /* Post F01 */
5  AactCoordinator.rnInterfaceIN.ieSendAnAlert(self)
6  )
7  then (result = true)
8  else (result = false)
9  endif}
10

```

Listing 5.31: **Messir** (MCL-oriented) specification of the operation *isSentToCoordinator*.

The listing 5.32 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctAlert,isSentToCoordinator,[Self,AactCoordinator],
7   Result):- 
8
9/* Post F01 */
10(
11 msrNav([AactCoordinator],
12   [rnInterfaceIN,ieSendAnAlert,[Self] ],
13   [[ptBoolean,true]])
14)
15-> Result = [ptBoolean,true]
16; Result = [ptBoolean,false]
17.

```

Listing 5.32: **Messir** (Prolog-oriented) implementation of the operation *isSentToCoordinator*.

5.10 Primary Types - Operation Schemes for Class ctAuthenticated

5.10.1 Operation Model for init

The *init* operation has the following properties:

| OPERATION | |
|--|---|
| <i>init</i> | |
| used to initialize the current object as a new instance of the ctAuthenticated type. | |
| <i>Parameters</i> | |
| 1 | Alogin: dtLogin used to initialize the login field |
| 2 | Apwd: dtPassword used to initialize the password field |
| 3 | AphoneNumber: dtPhoneNumber used to initialize the phone number field |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | true iff the system poststate includes the current object as a new ctAuthenticated instance having its attributes equal to the ones provided as parameters. |

The listing 5.33 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctAuthenticated, init, [Self,
7          Alogin,
8          Apwd],
9      Result):- 
10
11/* Post F01 */
12(
13msrVar(ctAuthenticated, Self),
14
15msrNav([Self], [login], [Alogin]),
16msrNav([Self], [pwd], [Apwd]),
17msrNav([Self], [vpIsLogged], [[ptBoolean, false]]),
18
19/* Post F02 */
20 msrNav([Self], [msrIsNew], [Self])
21)
22-> Result = [ptBoolean, true]
23; Result = [ptBoolean, false]
24.

```

Listing 5.33: **Messip** (Prolog-oriented) implementation of the operation *init*.

5.11 Primary Types - Operation Schemes for Class ctCoordinator

5.11.1 Operation Model for init

The *init* operation has the following properties:

| OPERATION | |
|-----------------------------------|--|
| <i>continues in next page ...</i> | |

... Operation table continuation

| | |
|--|---|
| init | used to initialize the current object as a new instance of the ctCoordinator type. |
| Parameters | |
| 1 Aid: dtCoordinatorID | used to initialize the id field |
| 2 Alogin: dtLogin | used to initialize the login field |
| 3 Apwd: dtPassword | used to initialize the password field |
| 4 AphoneNumber: dtPhoneNumber | used to initialize the phone number field |
| 5 AgeographicalLocation: etGeographicalLocation | used to initialize the geographical location field |
| 6 AcrisisType: etCrisisType | used to initialize the crisis type field |
| Return type | |
| ptBoolean | |
| Post-Condition (functional) | |
| PostF 1 | true iff the system poststate includes the current object as a new ctCoordinator instance having its attributes equal to the ones provided as parameters. |

The listing 5.34 provides the **MessiP** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{if
3  (
4  /* Post F01 */
5  let Self:ctCoordinator in
6  Self.id = Aid
7  and Self.login = Alogin
8  and Self.pwd = Apwd
9  and Self.phoneNumber = AphoneNumber
10 and Self.geographicalLocation = AgeographicalLocation
11 and Self.crisisType = AcrisisType
12 and Self.vpIsLogged = false
13 and Self.oclisNew = false
14 /* Post F02 */
15 and (Self.oclisNew and self = Self)
16 )
17 then (result = true)
18 else (result = false)
19 endif}

```

Listing 5.34: **MessiP** (MCL-oriented) specification of the operation *init*.

The listing 5.35 provides the **MessiP** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%

```

```

5
6msrop(ctCoordinator,init,[Self,
7          Aid,
8          Alogin,
9          Apwd],
10         Result):-
11
12/* Post F01 */
13(
14msrVar(ctCoordinator,Self),
15
16msrNav([Self],[id],[Aid]),
17msrNav([Self],[login],[Alogin]),
18msrNav([Self],[pwd],[Apwd]),
19msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),
20
21/* Post F02 */
22 msrNav([Self],[msrIsNew],[Self])
23)
24-> Result = [ptBoolean,true]
25; Result = [ptBoolean,false]
26.

```

Listing 5.35: **Messip** (Prolog-oriented) implementation of the operation *init*.

5.12 Primary Types - Operation Schemes for Class ctCrisis

5.12.1 Operation Model for init

The *init* operation has the following properties:

| OPERATION | |
|---|--|
| <i>init</i> | |
| used to initialize the current object as a new instance of the ctCrisis type. | |
| <i>Parameters</i> | |
| 1 | Aid: dtCrisisID used to initialize the id field |
| 2 | Atype: etCrisisType used to initialize the type field |
| 3 | Astatus: etCrisisStatus used to initialize the status field |
| 4 | Alocation: dtGPSLocation used to initialize the location field |
| 5 | Ainstant: dtDateAndTime used to initialize the instant field |
| 6 | Acomment: dtComment used to initialize the comment field |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | true iff the system poststate includes the current object as a new ctCrisis instance having its attributes equal to the ones provided as parameters. |

The listing 5.36 provides the **Messir** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{if
3    (
4      /* Post F01 */
5      let Self:ctCrisis in
6      Self.id = Aid
7      and Self.type = Atype
8      and Self.status = Astatus
9      and Self.location = Alocation
10     and Self.instant = Ainstant
11     and Self.comment = Acomment
12   /* Post F02 */
13   and (Self.oclisNew and self = Self)
14 )
15
16 then (result = true)
17 else (result = false)
18 endif}

```

Listing 5.36: **Messir** (MCL-oriented) specification of the operation *init*.

The listing 5.37 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis, init, [Self,
7  Aid,
8  Atype,
9  Astatus,
10 Alocation,
11 Ainstant,
12 Acomment],
13 Result):-!
14
15/* Post F01 */
16(
17msrVar(ctCrisis, Self),
18
19msrNav([Self], [id], [Aid]),
20msrNav([Self], [type], [Atype]),
21msrNav([Self], [status], [Astatus]),
22msrNav([Self], [location], [Alocation]),
23msrNav([Self], [instant], [Ainstant]),
24msrNav([Self], [comment], [Acomment]),
25
26/* Post F02 */
27 msrNav([Self], [msrIsNew], [Self])
28)
29-> Result = [ptBoolean,true]
30; Result = [ptBoolean,false]
31.

```

Listing 5.37: **Messir** (Prolog-oriented) implementation of the operation *init*.

5.12.2 Operation Model for handlingDelayPassed

The `handlingDelayPassed` operation has the following properties:

| OPERATION |
|---|
| handlingDelayPassed |
| used to determine if the crisis stood too longly in a pending status since last reminder. |
| Return type |
| ptBoolean |
| Post-Condition (functional) |
| PostF 1 true iff the crisis is in pending status and if the duration between the current ctState clock information and the last reminder is greater than the crisis reminder period duration. |

The listing 5.38 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheSystem:ctState in
4 let CurrentClockSecondsQty:dtInteger in
5 let vpLastReminderSecondsQty:dtInteger in
6 let CrisisReminderPeriod:dtSecond in
7 if
8 ( /* Post F01 */
9 self.rnSystem = TheSystem
10 and self.status = pending
11 and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
12 and TheSystem.vpLastReminder.toSecondsQty() = vpLastReminderSecondsQty
13 and TheSystem.crisisReminderPeriod = CrisisReminderPeriod
14 and CurrentClockSecondsQty.sub(vpLastReminderSecondsQty).gt(CrisisReminderPeriod) = true
15 )
16 then (result = true)
17 else (result = false)
18 endif}

```

Listing 5.38: **Messip** (MCL-oriented) specification of the operation *handlingDelayPassed*.

The listing 5.39 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,handlingDelayPassed, [Self],
7 Result):- 
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,LastReminderSecondsQty),
14 msrVar(dtSecond,CrisisReminderPeriod),
15
16 msrNav([Self],[rnSystem],[TheSystem]),
17
18 msrNav([Self],
19   [status],
20   [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23   [clock,toSecondsQty,[]],

```

```

24     [CurrentClockSecondsQty]),
25
26 msrNav([TheSystem],
27     [vpLastReminder,toSecondsQty,[],],
28     [LastReminderSecondsQty]),
29
30 msrNav([TheSystem],
31     [crisisReminderPeriod],
32     [CrisisReminderPeriod]),
33
34 msrNav([CurrentClockSecondsQty],
35     [sub,[LastReminderSecondsQty],
36     gt, [CrisisReminderPeriod]
37     ],
38     [[ptBoolean,true]])
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.

```

Listing 5.39: **Messip** (Prolog-oriented) implementation of the operation *handlingDelayPassed*.

5.12.3 Operation Model for maxHandlingDelayPassed

The `maxHandlingDelayPassed` operation has the following properties:

| OPERATION |
|--|
| <i>maxHandlingDelayPassed</i> |
| used to determine if the crisis stood too longly in a pending status since its creation. |
| <i>Return type</i> |
| <code>ptBoolean</code> |
| <i>Post-Condition (functional)</i> |
| PostF 1 true iff the crisis is in pending status and if the duration between the current <code>ctState</code> clock information and the crisis instant is greater than the maximum reminder period duration. |

The listing 5.40 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheSystem:ctState in
4 let CurrentClockSecondsQty:dtInteger in
5 let CrisisInstantSecondsQty:dtInteger in
6 let MaxCrisisReminderPeriod:dtSecond in
7 if
8 ( /* Post F01 */
9 self.rnSystem = TheSystem
10 and self.status = pending
11 and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
12 and Self.instant.toSecondsQty() = CrisisInstantSecondsQty
13 and TheSystem.maxCrisisReminderPeriod = MaxCrisisReminderPeriod
14 and CurrentClockSecondsQty.sub(CrisisInstantSecondsQty)
15         .gt(MaxCrisisReminderPeriod)
16 )
17 then (result = true)
18 else (result = false)
19 endif}

```

Listing 5.40: **Messip** (MCL-oriented) specification of the operation *maxHandlingDelayPassed*.

The listing 5.41 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,maxHandlingDelayPassed,[Self],
7    Result):-
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,CrisisInstantSecondsQty),
14 msrVar(dtSecond,MaxCrisisReminderPeriod),
15
16 msrNav([Self],[rnSystem],[TheSystem]),
17
18 msrNav([Self],
19     [status],
20     [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23     [clock,toSecondsQty,[],],
24     [CurrentClockSecondsQty]),
25
26 msrNav([Self],
27     [instant,toSecondsQty,[],],
28     [CrisisInstantSecondsQty]),
29
30 msrNav([TheSystem],
31     [maxCrisisReminderPeriod],
32     [MaxCrisisReminderPeriod]),
33
34 msrNav([CurrentClockSecondsQty],
35     [sub,[CrisisInstantSecondsQty],
36     gt, [MaxCrisisReminderPeriod]
37     ],
38     [[ptBoolean,true]]))
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.

```

Listing 5.41: **Messip** (Prolog-oriented) implementation of the operation *maxHandlingDelayPassed*.

5.12.4 Operation Model for isSentToCoordinator

The *isSentToCoordinator* operation has the following properties:

| OPERATION |
|---|
| <i>isSentToCoordinator</i> |
| used to provide a given coordinator with current crisis information. |
| <i>Parameters</i> |
| 1 AactCoordinator: actCoordinator the message destination actor |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |

continues in next page ...

... Operation table continuation

| | |
|---------|---|
| PostF 1 | true iff the message ieSendACrisis is sent by the simulator to the input interface of the given coordinator actor with the current crisis as parameter value. |
|---------|---|

The listing 5.42 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{if
3    (
4      /* Post F01 */
5      AactCoordinator.rnInterfaceIN.ieSendACrisis(self)
6    )
7    then (result = true)
8    else (result = false)
9  endif}
10

```

Listing 5.42: **Messip** (MCL-oriented) specification of the operation *isSentToCoordinator*.

The listing 5.43 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,isSentToCoordinator,[Self,AactCoordinator],
7      Result):- 
8
9/* Post F01 */
10(
11 msrNav([AactCoordinator],
12        [rnInterfaceIN,ieSendACrisis,[Self] ],
13        [[ptBoolean,true]])
14)
15-> Result = [ptBoolean,true]
16; Result = [ptBoolean,false]
17.

```

Listing 5.43: **Messip** (Prolog-oriented) implementation of the operation *isSentToCoordinator*.

5.12.5 Operation Model for *isAllocatedIfPossible*

The *isAllocatedIfPossible* operation has the following properties:

| OPERATION |
|--|
| <i>isAllocatedIfPossible</i> |
| used to allocate a crisis to a coordinator if any or to alert the administrator of crisis waiting to be handled. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |

continues in next page ...

...Operation table continuation

| | |
|---------|--|
| PostF 1 | true iff the duration between the crisis creation and the system's clock is greater than the maximum delay defined and |
| PostF 2 | if there exist at least one coordinator then (a) the post state associates to the crisis any of the existing coordinators and (b) the coordinator is informed that he is now the handlers of the crisis whose ID is communicated |
| PostF 3 | else a message is sent to all known administrators to request creation of new coordinators. |

The listing 5.44 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if (
4 /* Post F01 */
5 self.maxHandlingDelayPassed()
6 and
7 if (TheSystem.rnactCoordinator->msrIsEmpty = false)
8 then (
9 /* Post F02 */
10 TheSystem.rnactCoordinator->msrAny(true) = TheCoordinatorActor
11 and TheCoordinatorActor.rnctCoordinator = TheCoordinator
12 and self@post.rnHandler = TheCoordinator
13 and self@post.status = handled
14 and self.id.value = TheCrisisIDptString
15 and 'You are now considered as handling the crisis having ID: '
16 .ptStringConcat(TheCrisisIDptString) = TheMessage
17 and TheCoordinatorActor.rnInterfaceIN^ieMessage(TheMessage)
18 )
19 else ( /* Post F03 */
20 TheSystem.rnactAdministrator
21 ->forAll(rnInterfaceIN.ieMessage('Please add new coordinators to handle pending crisis !'))
22 )
23 endif
24 )
25 then (result = true)
26 else (result = false)
27 endif}

```

Listing 5.44: **Messip** (MCL-oriented) specification of the operation *isAllocatedIfPossible*.

The listing 5.45 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,isAllocatedIfPossible,[Self],
7 Result):-
8(
9 msrVar(ctState,TheSystem),
10 msrNav([Self],[rnSystem],[TheSystem]),
11
12 msrVar(actCoordinator,TheCoordinatorActor),
13 msrVar(ctCoordinator,TheCoordinator),
14 msrVar(ptString,TheMessage),
15 msrVar(ptString,TheCrisisIDptString),
16

```

```

17 (
18 /* Post F01 */
19 msrNav([Self],
20 [maxHandlingDelayPassed, []],
21 [[ptBoolean,true]]),
22
23 ( msrNav([TheSystem],
24 [rnactCoordinator,msrIsEmpty],
25 [[ptBoolean,false]])
26 -> (
27 /* Post F02 */
28 msrNav([TheSystem],
29 [rnactCoordinator,msrAny,msrTrue],
30 [TheCoordinatorActor]),
31
32 msrNav([TheCoordinatorActor],
33 [rnctCoordinator],
34 [TheCoordinator]),
35
36 msrNav([Self],
37 [msmAtPost,rnHandler],
38 [TheCoordinator]),
39
40 msrNav([Self],
41 [msmAtPost,status],
42 [[etCrisisStatus,handled]]),
43
44 msrNav([Self],
45 [id,value],
46 [TheCrisisIDptString]),
47
48 msrNav([[ptString,'You are now considered as handling the crisis having ID:']],
49 [ptStringConcat,[TheCrisisIDptString]],
50 [TheMessage]),
51
52 msrNav([TheCoordinatorActor],
53 [rnInterfaceIN,
54 ieMessage,[TheMessage]
55 ],
56 [[ptBoolean,true]])
57 )
58 ; /* Post F03 */
59 msrNav([TheSystem],
60 [rnactAdministrator,msrForAll,rnInterfaceIN,
61 ieMessage,[[ptString,'Please add new coordinators to handle pending crisis !']]],
62 [[ptBoolean,true]])
63 )
64 )
65 )
66)
67-> Result = [ptBoolean,true]
68; Result = [ptBoolean,false]
69.

```

Listing 5.45: **Messip** (Prolog-oriented) implementation of the operation *isAllocatedIfPossible*.

5.13 Primary Types - Operation Schemes for Class ctHuman

5.13.1 Operation Model for init

The *init* operation has the following properties:

| OPERATION |
|--|
| <i>init</i> |
| used to initialize the current object as a new instance of the ctHuman type. |

continues in next page ...

... Operation table continuation

| <i>Parameters</i> | |
|------------------------------------|---|
| 1 | Aid: dtPhoneNumber used to initialize the id field |
| 2 | Akind: etHumanKind used to initialize the kind field |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | true iff the system poststate includes the current object as a new ctHuman instance having its attributes equal to the ones provided as parameters. |

The listing 5.46 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{if
3  (
4  /* Post F01 */
5  let Self:ctHuman in
6  Self.id = Aid
7  and Self.kind = Akind
10 /* Post F02 */
12 and (Self.oclIsNew and self = Self)
13 )
14 then (result = true)
15 else (result = false)
16 endif}

```

Listing 5.46: **Messip** (MCL-oriented) specification of the operation *init*.

The listing 5.47 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5
6msrop(ctHuman, init, [Self,
7      Aid,
8      Akind],
9  Result):-!
10
11/* Post F01 */
12(
13msrVar(ctHuman, Self),
14
15msrNav([Self], [id], [Aid]),
16msrNav([Self], [kind], [Akind]),
17
18/* Post F02 */
19 msrNav([Self], [msrIsNew], [Self])
20)
21-> Result = [ptBoolean,true]

```

```

22; Result = [ptBoolean, false]
23.

```

Listing 5.47: **Messip** (Prolog-oriented) implementation of the operation *init*.

5.13.2 Operation Model for isAcknowledged

The *isAcknowledged* operation has the following properties:

| OPERATION | |
|--|--|
| <i>isAcknowledged</i> | |
| used to specify the property of having sent an alert acknowledge message to the human having declared the alert through its own communication company. | |
| <i>Return type</i> | |
| ptBoolean | |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | true iff the message ieSmsSend is sent to the related input interface of the related communication company actor with the human phone number and the generic message 'The handling of your alert by our services is in progress !' |

The listing 5.48 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctHuman,isAcknowledged,[Self],Result):- 
7
8/* Post F01 */
9(msrVar(dtPhoneNumber,AdtPhoneNumber),
10 msrVar(dtSMS,AdtSMS),
11
12 msrNav([Self],
13     [id,eq,[AdtPhoneNumber]],
14     [[ptBoolean,true]]),
15 msrNav([AdtSMS],
16     [value,eq,[[ptString,'The handling of your alert by our services is in progress !']]],
17     [[ptBoolean,true]]),
18 msrNav([Self],
19     [rnactComCompany,rnInterfaceIN,ieSmsSend,[AdtPhoneNumber,AdtSMS]],
20     [[ptBoolean,true]])
21)
22-> Result = [ptBoolean,true]
23; Result = [ptBoolean,false]
24.

```

Listing 5.48: **Messip** (Prolog-oriented) implementation of the operation *isAcknowledged*.

5.14 Primary Types - Operation Schemes for Class ctState

5.14.1 Operation Model for init

The *init* operation has the following properties:

| OPERATION | |
|--|---|
| <i>init</i> | |
| used to initialize the current object as a new instance of the ctState type. | |
| Parameters | |
| 1 AnextValueForAlertID: dtInteger | used to initialize the nextValueForAlertID field |
| 2 AnextValueForCrisisID: dtInteger | used to initialize the nextValueForCrisisID field |
| 3 Aclock: dtDateAndTime | used to initialize the clock field |
| 4 AcrisisReminderPeriod: dtSecond | used to initialize the crisisReminderPeriod field |
| 5 AmaxCrisisReminderPeriod: dtSecond | used to initialize the maxCrisisReminderPeriod field |
| 6 AvpLastReminder: dtDateAndTime | used to initialize the vpLastReminder field |
| 7 AvpStarted: ptBoolean | used to initialize the vpStarted field |
| Return type | |
| ptBoolean | |
| Post-Condition (functional) | |
| PostF 1 | true iff the system poststate includes the current object as a new ctState instance having its attributes equal to the ones provided as parameters. |

The listing 5.49 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{if
3  (
4  /* Post F01 */
5  let Self:ctState in
6
7
8  Self.nextValueForAlertID = AnextValueForAlertID
9  and Self.nextValueForCrisisID = AnextValueForCrisisID
10 and Self.clock = Aclock
11 and Self.crisisReminderPeriod = AcrisisReminderPeriod
12 and Self.maxCrisisReminderPeriod = AmaxCrisisReminderPeriod
13 and Self.vpLastReminder = AvpLastReminder
14 and Self.vpStarted = AvpStarted
15
16 and (Self.oclisNew and self = Self)
17 )
18 then (result = true)
19 else (result = false)
20 endif}
```

Listing 5.49: **Messip** (MCL-oriented) specification of the operation *init*.

The listing 5.50 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctState,init,[Self,
7      AnextValueForAlertID,
8      AnextValueForCrisisID,
9      Aclock,
10     AcrisisReminderPeriod,
11     AmaxCrisisReminderPeriod,
12     AvpLastReminder,
13     AvpStarted],
14   Result):-
15
16 /* Post F01 */
17(
18 msrVar(ctState,Self),
19
20 msrNav([Self],[nextValueForAlertID],[AnextValueForAlertID]),
21 msrNav([Self],[nextValueForCrisisID],[AnextValueForCrisisID]),
22 msrNav([Self],[clock],[Aclock]),
23 msrNav([Self],[crisisReminderPeriod],[AcrisisReminderPeriod]),
24 msrNav([Self],[maxCrisisReminderPeriod],[AmaxCrisisReminderPeriod]),
25 msrNav([Self],[vpLastReminder],[AvpLastReminder]),
26 msrNav([Self],[vpStarted],[AvpStarted]),
27
28 msrNav([Self],[msrIsNew],[Self])
29)
30-> Result = [ptBoolean,true]
31; Result = [ptBoolean,false]
32.

```

Listing 5.50: **Messir** (Prolog-oriented) implementation of the operation *init*.

5.15 Primary Types - Operation Schemes for Datatype dtAlertID

5.15.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|--|
| <i>is</i> |
| used to determine which strings are considered as valid alert identifiers. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 if the length of the value attribute of a dtAlertID is a ptInteger greater than zero and lower or equal to 20 then the operation returns the ptBoolean true, else the ptBoolean false. |

The listing 5.51 provides the **Messir** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( AdtValue.value.length().gt(0)
6     and AdtValue.value.length().leq(20)

```

```

7      )
8      then (TheResult = true)
9      else (TheResult = false)
10     endif
11     result = TheResult
12   ) }
```

Listing 5.51: **Messir** (MCL-oriented) specification of the operation *is*.

The listing 5.52 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(dtAlertID,is,[AdtValue],Result):-%
7% msd01
8msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]],
12   [[ptBoolean,true]]) ,
13   msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,20]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20TheResult = Result
21.
22
23*/
24| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]]],[]]],%
25msrNav([X],[is,[],[Result]).
26
27X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]]],[]]],%
28Result = [ptBoolean,true] ?
29
30yes
31
32| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'012345678901234567890123456789']]]],[]]],%
33msrNav([X],[is,[],[Result]).
34
35X = [dtAlertID,[],[[dtString,[[value,[ptString,'012345678901234567890123456789']]]],[]]],%
36Result = [ptBoolean,false] ?
37
38yes
39*/
```

Listing 5.52: **Messir** (Prolog-oriented) implementation of the operation *is*.

5.16 Primary Types - Operation Schemes for Datatype dtCode

5.16.1 Operation Model for *is*

The *is* operation has the following properties:

| |
|------------------|
| OPERATION |
|------------------|

continues in next page ...

... Operation table continuation

| |
|--|
| <i>is</i> |
| used to determine which strings are considered as valid generated codes. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 is true if the length of the generated code value is equals 6 characters. |

The listing 5.53 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    let MaxLength: ptInteger in
4    ( if
5      (generatedCode.value.length() .eq(6))
6      then (TheResult = true)
7      else (TheResult = false)
8      endif
9      result = TheResult
10    ) }
11  }
```

Listing 5.53: **Messip** (MCL-oriented) specification of the operation *is*.

5.17 Primary Types - Operation Schemes for Datatype dtComment

5.17.1 Operation Model for *is*

The *is* operation has the following properties:

| |
|---|
| OPERATION |
| <i>is</i> |
| used to determine which strings are considered as valid comments. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 true iff the length of the string value is not more than 160 characters. |

The listing 5.54 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    ( if
4      ( MaxLength = 160
5      and AdtValue.value.length() .leq(MaxLength)
6      )
7      then (TheResult = true)
8      else (TheResult = false)
9    ) }
```

```

10      endif
11      result = TheResult
12  ) }

```

Listing 5.54: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.55 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtComment,is,[AdtValue],Result):-%
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11 (
12   (
13     (
14       MaxLength = [ptInteger,160],
15       msrNav([AdtValue],
16           [value,length,[],leq,[MaxLength]],
17           [[ptBoolean,true]])
18     )
19     -> TheResult = [ptBoolean,true]
20     ; TheResult = [ptBoolean,false]
21   )
22),
23 Result = TheResult
24.
25
26/*
27| ?- X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg ! Please help ...']]],[[]]]],%
28msrNav([X],[is,[],[Result]) .
29X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg ! Please help ...']]],[[]]]],%
30Result = [ptBoolean,true] ?
31yes
32
33| ?- X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg when I was running with my dog
            to go to the skate park because my friends called me on my mobile phone and told me that a skate
            star was doing triple back flips.']]],[[]]]],%
34msrNav([X],[is,[],[Result]) .
35X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg when I was running with my dog to go
            to the skate park because my friends called me on my mobile phone and told me that a skate star
            was doing triple back flips.']]],[[]]]],%
36Result = [ptBoolean,false] ?
37yes
38*/

```

Listing 5.55: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.18 Primary Types - Operation Schemes for Datatype dtCoordinatorID

5.18.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION | |
|------------------------------------|---|
| <i>is</i> | used to determine which string are considered as valid alert identifiers. |
| <i>Return type</i> | ptBoolean |
| <i>Post-Condition (functional)</i> | |
| PostF 1 | if the length of the value attribute of a dtCoordinatorID is a ptInteger greater than zero and lower or equal to 5 than the operation returns the ptBoolean true, else the ptBoolean false. |

The listing 5.56 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    if
4      ( AdtValue.value.length().gt(0)
5        and AdtValue.value.length().leq(5)
6      )
7      then (TheResult = true)
8      else (TheResult = false)
9    endif
10   result = TheResult
11 }
12 }
```

Listing 5.56: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.57 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(dtCoordinatorID,is,[AdtValue],Result):-
7% msd01
8 msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]],
12   [[ptBoolean,true]]),
13   msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,5]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20 TheResult = Result
21.
```

Listing 5.57: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.19 Primary Types - Operation Schemes for Datatype dtCrisisID

5.19.1 Operation Model for is

The `is` operation has the following properties:

| OPERATION |
|--|
| <i>is</i> |
| used to determine which strings are considered as valid crisis identifiers. |
| <i>Return type</i> |
| <code>ptBoolean</code> |
| <i>Post-Condition (functional)</i> |
| PostF 1 if the length of the value attribute of a <code>dtAlertID</code> is a <code>ptInteger</code> greater than zero and lower or equal to 20 then the operation returns the <code>ptBoolean</code> true, else the <code>ptBoolean</code> false. |

The listing 5.58 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    if
4      ( AdtValue.value.length().gt(0)
5        and AdtValue.value.length().leq(10)
6      )
7    then (TheResult = true)
8    else (TheResult = false)
9  endif
10  result = TheResult
11 }
12 }
```

Listing 5.58: **Messip** (MCL-oriented) specification of the operation `is`.

The listing 5.59 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(dtCrisisID,is,[AdtValue],Result):-%
7% msd01
8 msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]],
12   [[ptBoolean,true]]),
13   msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,10]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20 TheResult = Result
21.
```

```

22/*
23| ?- X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789']]]],[],[],[],],
24msrNav([X],[is,[],[Result]) .
25X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789']]]],[],[],[],],
26Result = [ptBoolean,true] ?
27yes
28
29| ?- X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789a']]]],[],[],[],],
30msrNav([X],[is,[],[Result]) .
31X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789a']]]],[],[],[],],
32Result = [ptBoolean,false] ?
33yes
34*/

```

Listing 5.59: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.20 Primary Types - Operation Schemes for Datatype dtGPSLocation

5.20.1 Operation Model for getGeographicalLocation

The `getGeographicalLocation` operation has the following properties:

| OPERATION | |
|--|--|
| <i>getGeographicalLocation</i> | |
| method which defines if the given geographical location equals to the crisis/alert geographical location | |
| Parameters | |
| 1 | EtGeographicalLocation: etGeographicalLocation the given geographical location of a coodrinator expertise domaine |
| Return type | |
| ptBoolean | |
| Post-Condition (functional) | |
| PostF 1 | according to distance between the center of the current city(Saint-Petersburg) and coordinate which is measured with the help of latitude and longitude the method defines the geographical location of a crisis or an alert. Then this geographical location is compared with the given geographical location |

5.20.2 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION | |
|---|---|
| <i>is</i> | |
| used to determine which couples are considered as valid dtGPSLocation values. | |
| Return type | |
| ptBoolean | |
| Post-Condition (functional) | |
| PostF 1 | true if both latitude and longitude are valid values according to their is operation. |

The listing 5.60 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    ( if
4      ( AdtValue.latitude.is()
5        and AdtValue.longitude.is
6      )
7    then (TheResult = true)
8    else (TheResult = false)
9    endif
10   result = TheResult
11 }
12 }
```

Listing 5.60: **Messir** (MCL-oriented) specification of the operation *is*.

The listing 5.61 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% dtPhoneNumber
7
8% msd01
9msrop(dtGPSLocation,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12  (
13    msrNav([AdtValue],
14      [latitude,is,[],[[ptBoolean,true]]]),
15    msrNav([AdtValue],
16      [longitude,is,[],[[ptBoolean,true]]])
17  )
18
19 )
20 -> TheResult = [ptBoolean,true]
21 ; TheResult = [ptBoolean,false]
22),
23
24 Result = TheResult
25.
```

Listing 5.61: **Messir** (Prolog-oriented) implementation of the operation *is*.

5.20.3 Operation Model for *isNearTo*

The *isNearTo* operation has the following properties:

| OPERATION |
|--|
| <i>isNearTo</i> |
| used to determine if locations are considered enough close to be treated as equivalent in the application domain context. In the context of the iCrash system, we compute the distance between two GPS locations using the following Haversine formula. (more details can be found at: http://www.movable-type.co.uk/scripts/latlong.html and http://www.gpsvisualizer.com/calculators#distance) |
| Parameters |
| 1 AGPSLocation: dtGPSLocation the GPS location to be compared to. |

continues in next page ...

... Operation table continuation

| <i>Return type</i> |
|--|
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 if the Haversine formula ($\text{ACOS}(\text{SIN}(\text{lat1}) * \text{SIN}(\text{lat2}) + \text{COS}(\text{lat1}) * \text{COS}(\text{lat2}) * \text{COS}(\text{lon2} - \text{lon1})) * 6371$, in which latitudes and longitudes are in radians applied to the two dtGPS coordinates is lower to 100 meters) then the predicate is true and false otherwise. |

The listing 5.62 provides the **Messir** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in true
3    let EarthRadius: dtReal in
4    let MaxDistance: dtReal in
5    let ComparedLatitude: dtLatitude in
6    let ComparedLongitude: dtLongitude in
7    let R1: dtReal in let R1a: dtReal in
8    let R2: dtReal in let R2a: dtReal in
9
10
11  ( if
12    ( EarthRadius.value = 6371
13      and MaxDistance.value = 100
14
15      and AdtValue.latitude = ComparedLatitude
16      and AdtValue.longitude = ComparedLongitude
17      and Self.latitude.sin() = R1a
18      and AdtValue.latitude.sin().mul(R1a) = R1
19      and Self.latitude.cos() = R2a
20      and AdtValue.latitude.cos().mul(R2a) = R2
21
22      and AdtValue.longitude = ComparedLongitude
23      and Self.longitude.sub(ComparedLongitude).cos().mul(R2)
24        .add(R1).acos().mul(EarthRadius).sub(MaxDistance)
25        .value.leq(0)
26    )
27  then (TheResult = true)
28  else (TheResult = false)
29  endif
30  result = TheResult
31 }
```

Listing 5.62: **Messir** (MCL-oriented) specification of the operation *isNearTo*.

The listing 5.63 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% dtGPSLocation
7
8msrop(dtGPSLocation,isNearTo,[Self,AdtValue],Result):-
9msrVar(ptBoolean,TheResult),
10msrVar(dtReal,EarthRadius),
11msrVar(dtReal,MaxDistance),
12
```

```

13msrVar(dtLatitude,ComparedLatitude),
14msrVar(dtLongitude,ComparedLongitude),
15
16msrVar(dtReal,R1),msrVar(dtReal,R1a),
17msrVar(dtReal,R2),msrVar(dtReal,R2a),
18
19(
20 (
21 (
22 % msd01
23 msrNav([EarthRadius],[value],[[ptReal,6371]]),
24 msrNav([MaxDistance],[value],[[ptReal,100]]),
25
26 msrNav([AdtValue],[latitude],[ComparedLatitude]),
27 msrNav([AdtValue],[longitude],[ComparedLongitude]),
28
29 msrNav([Self],[latitude,sin,[]],[R1a]),
30 msrNav([AdtValue],[latitude,sin,[],mul,[R1a]],[R1]),
31
32 msrNav([Self],[latitude,cos,[]],[R2a]),
33 msrNav([AdtValue],[latitude,cos,[],mul,[R2a]],[R2]),
34
35 msrNav([AdtValue],[longitude],[ComparedLongitude]),
36 msrNav([Self],[longitude,sub,[ComparedLongitude],cos,[],mul,[R2],
37 add,[R1],
38 acos,[],
39 mul,[EarthRadius],
40 sub,[MaxDistance],
41 value,leq,[[ptReal,0]]],
42 [[ptBoolean,true]])
43 )
44 -> TheResult = [ptBoolean,true]
45 ; TheResult = [ptBoolean,false]
46 )
47),
48 Result = TheResult
49.
```

Listing 5.63: **Messip** (Prolog-oriented) implementation of the operation *isNearTo*.

5.21 Primary Types - Operation Schemes for Datatype dtLatitude

5.21.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|---|
| <i>is</i> |
| used to determine which strings are considered as valid dtLatitude. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 is true if the value is a real in the interval [-90.0 , +90.0]. |

The listing 5.64 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
```

```

3 postF{let TheResult: ptBoolean in
4   ( if
5     ( AdtValue.value.geq(-90.0)
6       and AdtValue.value.leq(+90.0)
7     )
8     then (TheResult = true)
9     else (TheResult = false)
10  endif
11  result = TheResult
12 ) }

```

Listing 5.64: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.65 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% msd01
7msrop(dtLatitude,is,[AdtValue],Result):-%
8msrVar(ptBoolean,TheResult),%
9(
10 ( msrNav([AdtValue],%
11   [value,geq,[[ptReal,-90.0]]],%
12   [[ptBoolean,true]]),%
13  msrNav([AdtValue],%
14   [value,leq,[[ptReal,+90.0]]],%
15   [[ptBoolean,true]])%
16 )
17 -> (TheResult = [ptBoolean,true])%
18 ; (TheResult = [ptBoolean,false])%
19),
20Result = TheResult
21.

```

Listing 5.65: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.22 Primary Types - Operation Schemes for Datatype dtLogin

5.22.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|--|
| <i>is</i> |
| used to determine which strings are considered as valid dtLogin. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 is true of the length of the string value is not more than 20 characters. |

The listing 5.66 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    let MaxLength: ptInteger in
4    ( if
5      ( MaxLength = 20
6        and AdtValue.value.length().leq(MaxLength)
7      )
8    )
9    then (TheResult = true)
10   else (TheResult = false)
11  endif
12  result = TheResult
13 }

```

Listing 5.66: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.67 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtLogin,is,[AdtValue],Result):-
9  msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11 (
12  (
13    (
14      MaxLength = [ptInteger,20],
15      msrNav([AdtValue],
16          [value,length,[],leq,[MaxLength]],
17          [[ptBoolean,true]])
18    )
19    -> TheResult = [ptBoolean,true]
20    ; TheResult = [ptBoolean,false]
21  )
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567']]],[[]]]],
27msrNav([X],[is,[],[Result]]).
28X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567']]],[[]]]],
29Result = [ptBoolean,true] ?
30yes
31
32| ?- X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567a']]],[[]]]],
33msrNav([X],[is,[],[Result]]).
34X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567a']]],[[]]]],
35Result = [ptBoolean,false] ?
36yes
37*/

```

Listing 5.67: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.23 Primary Types - Operation Schemes for Datatype dtLongitude

5.23.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|---|
| <i>is</i> |
| used to determine which strings are considered as valid dtLongitude. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 is true if the value is a real in the interval [-180.0 , +180.0]. |

The listing 5.68 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2 postF{let TheResult: ptBoolean in
3   ( if
4     ( AdtValue.value.geq(-180.0)
5       and AdtValue.value.leq(+180.0)
6     )
7     then (TheResult = true)
8     else (TheResult = false)
9   endif
10  result = TheResult
11 )}
```

Listing 5.68: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.69 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1% % % % % % % % % % % % % % % % %
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4% % % % % % % % % % % % % % % % %
5
6%% dtPhoneNumber
7
8% msd01
9msrop(dtLongitude,is,[AdtValue],Result):-%
10msrVar(ptBoolean,TheResult),%
11(
12 ( msrNav([AdtValue],%
13   [value,geq,[[ptReal,-180.0]]],%
14   [[ptBoolean,true]]),%
15   msrNav([AdtValue],%
16   [value,leq,[[ptReal,+180.0]]],%
17   [[ptBoolean,true]])%
18 )
19 -> (TheResult = [ptBoolean,true])%
20 ; (TheResult = [ptBoolean,false])%
21),
22
23 Result = TheResult
24.
```

Listing 5.69: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.24 Primary Types - Operation Schemes for Datatype dtPassword

5.24.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|--|
| <i>is</i> |
| used to determine which strings are considered as valid dtPassword. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 is true if the length of the string value is at least 6 characters long. |

The listing 5.70 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    let MinLength: ptInteger in
4    ( if
5      ( MinLength = 6
6        and AdtValue.value.length().geq(MinLength)
7      )
8      then (TheResult = true)
9      else (TheResult = false)
10     endif
11     result = TheResult
12   ) }
```

Listing 5.70: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.71 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtPassword,is,[AdtValue],Result):-%
9  msrVar(ptBoolean,TheResult),%
10 msrVar(ptInteger,MinLength),%
11 (%
12  (%
13   (
14     MinLength = [ptInteger,6],%
15     msrNav([AdtValue],%
16             [value,length,[],geq,[MinLength]],%
17             [[ptBoolean,true]]))%
18   )%
19   -> TheResult = [ptBoolean,true]%
20   ; TheResult = [ptBoolean,false]%
21 )%
22),
```

```

23 Result = TheResult
24.
25 /*
26 | ?- X = [dtPassword,[],[[dtString,[[value,[ptString,'012345']]],[[]]]],,
27 msrNav([X],[is,[],[Result]]).
28 X = [dtPassword,[],[[dtString,[[value,[ptString,'012345']]],[[]]]],,
29 Result = [ptBoolean,true] ?
30 yes
31
32 | ?- X = [dtPassword,[],[[dtString,[[value,[ptString,'01234']]],[[]]]],,
33 msrNav([X],[is,[],[Result]]).
34 X = [dtPassword,[],[[dtString,[[value,[ptString,'01234']]],[[]]]],,
35 Result = [ptBoolean,false] ?
36 yes
37 */

```

Listing 5.71: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.25 Primary Types - Operation Schemes for Datatype dtPhoneNumber

5.25.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|---|
| <i>is</i> |
| used to determine which strings are considered as valid dtPhoneNumber. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 is true if the length of the string value is from 4 to 30 characters. No standard is applied ! |

The listing 5.72 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( AdtValue.value.length().gt(4)
6     and AdtValue.value.length().leq(30)
7   )
8   then (TheResult = true)
9   else (TheResult = false)
10  endif
11  result = TheResult
12 ) }

```

Listing 5.72: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.73 provides the **Messip** (Prolog-oriented) implementation of the operation.

¹%%%%%%%%%%%%%%

```

2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% dtPhoneNumber
7
8% msd01
9msrop(dtPhoneNumber,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12 ( msrNav([AdtValue],
13   [value,length,[],gt,[[ptInteger,4]]],
14   [[ptBoolean,true]]),
15   msrNav([AdtValue],
16   [value,length,[],leq,[[ptInteger,30]]],
17   [[ptBoolean,true]])
18 )
19
20 -> TheResult = [ptBoolean,true]
21 ; TheResult = [ptBoolean,false]
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtPhoneNumber,[],[[dtString,[[value,[ptString,'(+352) 46 66 44 60 00']]]],[]]],%
27msrNav([X],[is,[],[Result]]).
28
29X = [dtPhoneNumber,[],[[dtString,[[value,[ptString,'(+352) 46 66 44 60 00']]]],[]]],%
30
31Result = [ptBoolean,true] ?
32
33yes
34*/

```

Listing 5.73: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.26 Primary Types - Operation Schemes for Enumeration etAlertStatus

5.26.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|---|
| <i>is</i> |
| used to determine which literal belongs to the enumeration. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 true iff the value is equal to one of the following values: pending, valid, invalid |

The listing 5.74 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if

```

```

5      ( self = pending
6      or self = valid
7      or self = invalid
8    )
9    then (TheResult = true)
10   else (TheResult = false)
11   endif
12   result = TheResult
13 )

```

Listing 5.74: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.75 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% etAlertStatus
7
8% msd01
9msrop(etAlertStatus,is,[AdtValue],Result):-%
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[pending, valid, invalid]))
14  )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.

```

Listing 5.75: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.27 Primary Types - Operation Schemes for Enumeration etCrisisStatus

5.27.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|---|
| <i>is</i> |
| used to determine which litteral belongs to the enumeration. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 true iff the value is equal to one of the following values: pending, handled, solved, closed. |

The listing 5.76 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    ( if
4      ( self = pending
5        or self = handled
6        or self = solved
7        or self = closed
8      )
9    )
10   then (TheResult = true)
11   else (TheResult = false)
12  endif
13  result = TheResult
14 }

```

Listing 5.76: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.77 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% etCrisisStatus
7
8% msd01
9msrop(etCrisisStatus,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[pending, handled, solved, closed])
14  )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.

```

Listing 5.77: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.28 Primary Types - Operation Schemes for Enumeration etCrisisType

5.28.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|---|
| <i>is</i> |
| used to determine which litteral belongs to the enumeration. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 true iff the value is equal to one of the following values: low, medium, high, critical |

The listing 5.78 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3      ( if
4          ( self = critical
5          or self = medium
6          or self = high
7          or self = low
8      )
9      then (TheResult = true)
10     else (TheResult = false)
11  endif
12  result = TheResult
13 ) }
14 }
```

Listing 5.78: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.79 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% etCrisisType
7
8% msd01
9msrop(etCrisisType,is,[AdtValue],Result):-%
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[small, medium, huge])
14  )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.
```

Listing 5.79: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.29 Primary Types - Operation Schemes for Enumeration etGeographicalLocation

5.29.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|--|
| <i>is</i> |
| used to determine which litteral belongs to the enumeration. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |

continues in next page ...

...Operation table continuation

| | |
|---------|---|
| PostF 1 | true iff the value is equal to one of the following values: central, southWestern, northWestern, southEastern, northEastern |
|---------|---|

The listing 5.80 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    ( if
4      ( self = central
5      or self = southEastern
6      or self = southWestern
7      or self = northEastern
8      or self = northWestern
9    )
10   then (TheResult = true)
11   else (TheResult = false)
12   endif
13   result = TheResult
14 }
15 }
```

Listing 5.80: **Messip** (MCL-oriented) specification of the operation *is*.

5.30 Primary Types - Operation Schemes for Enumeration etHumanKind

5.30.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|---|
| <i>is</i> |
| used to determine which litteral belongs to the enumeration. |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 true iff the value is equal to one of the following values: witness, victim, anonym |

The listing 5.81 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    ( if
4      ( self = witness
5      or self = victim
6      or self = anonymous
7    )
8   then (TheResult = true)
9   else (TheResult = false)
10 }
```

```

11      endif
12      result = TheResult
13  )

```

Listing 5.81: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.82 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% etHumanKind
7
8% msd01
9msrop(etHumanKind,is,[AdtValue],Result):-%
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[witness,victim,anonymous])
14  )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.

```

Listing 5.82: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.31 Secondary Types - Operation Schemes for Classes

There are no elements in this category in the system analysed.

5.32 Secondary Types - Operation Schemes for Datatype dtSMS

5.32.1 Operation Model for *is*

The *is* operation has the following properties:

| OPERATION |
|--|
| <i>is</i> |
| used to determine which strings are considered as valid comments |
| <i>Return type</i> |
| ptBoolean |
| <i>Post-Condition (functional)</i> |
| PostF 1 true iff the length of the string value is not more than 160 characters. |

The listing 5.83 provides the **Messip** (MCL-oriented) specification of the operation.

```

2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   let MaxLength: ptInteger in
5   ( if
6     ( MaxLength = 160
7       and AdtValue.value.length() .leq (MaxLength)
8     )
9     then (TheResult = true)
10    else (TheResult = false)
11  endif
12  result = TheResult
13 ) }

```

Listing 5.83: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.84 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtSMS,is,[AdtValue],Result):-%
9 msrVar(ptBoolean,TheResult),%
10 msrVar(ptInteger,MaxLength),%
11 (%
12   (
13   (
14     MaxLength = [ptInteger,160],%
15     msrNav([AdtValue],%
16       [value,length,[],leq,[MaxLength]],%
17       [[ptBoolean,true]])%
18   )%
19   -> TheResult = [ptBoolean,true]%
20   ; TheResult = [ptBoolean,false]%
21   )%
22),
23 Result = TheResult
24.

```

Listing 5.84: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.33 Secondary Types - Operation Schemes for Enumerations

There are no elements in this category in the system analysed.

Chapter 6

Test Model(s)

6.1 Test Model for testcase01

this positive test case intends to verify the correctness of the execution of a simple instance of the suDeployAndRun use case.

6.1.1 Test Steps Specification

6.1.1.1 testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreateSy

The testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreateSy has the following properties:

| TEST STEP | |
|--|---|
| <i>ts01oeCreateSystemAndEnvironment</i> | |
| This test step initializes the system state and environment. | |
| <i>Test Sent Message</i> | |
| TSM 1 | <p>out:Creator</p> <p>sends to system</p> <p>actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment (AqtyComCompanies)</p> |
| <i>Variables</i> | |
| V 1 | Creator:icrash.environment.actMsrCreator only actMsrCreator actors can trigger the system and environment creation and initialization. |
| <i>Constraints</i> | |
| C 1 | the number of communication company actor instances present in the environment is equal to four to represent all the communication companies available in Luxembourg. |
| <i>Oracle Constraints</i> | |
| OC 1 | true for testing only the executability (is available and can be triggered) of the operation. |

The listing 6.1 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   Creator:actMsrCreator
4   AqtyComCompanies: ptInteger
5 }
6
7 constraints{
8   AqtyComCompanies = 4
9 }
10
11 oracle{
12   constraints{
13     true
14   }
15 }
```

Listing 6.1: **Messir** (MCL-oriented) specification of the test step *testcase01-ts01oeCreateSystemAndEnvironment*.

The listing 6.2 provides the **Messir** (Prolog-oriented) implementation of the test step.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrTest/1.
4%%%%%%%%%%%%%
5
6%-----7:-msrTestAddStep([system,sim,1,1]).8%-----9msrTest([[system,sim,1,1],
10      [target,oeCreateSystemAndEnvironment],
11      [context,Context],
12      [inputParameters,InputParameters],
13      [outputParameters,OutputParameters],
14      [comments,Comments],
15      TestResult]
16    ]):-
17%-----18(
19 (
20% Step 0
21
22%% Context Declaration
23%% N.A.
24
25%% Input Parameters Declaration
26msrVar(ptInteger,AqtyComCompanies),
27
28%% Output Parameters Declaration
29%% N.A.
30
31%% Context Specification
32%% N.A.
33
34%% Input Parameters Specification
35AqtyComCompanies = [ptInteger,4],
36
37%% Output Parameters Specification
38%% N.A.
39
40%% Test Specification
41Target = launchCreateSystemAndEnvironment,
42ParametersList =
43[ [AqtyComCompanies],
44 Result
45], !,
```

```

46GoalGet=..[Target | ParametersList],
47
48%% Oracle specification
49OracleGet=..[true]
50)
51->
52%% Test Interpretation
53((GoalGet,!)
54-> ((OracleGet,!)
55 -> TestResult = [success]
56 ; TestResult = [failedAtOracle])
57; TestResult = [failedAtGoal]
58)
59; TestResult = [failedAtTestDeclarationOrSpecification]
60),
61%% Test Outcome
62Context = [],
63InputParameters = ['AqtyComCompanies',AqtyComCompanies],
64OutputParameters = [],
65Comments = 'System launch ! '
66.

```

Listing 6.2: **Messir** (Prolog-oriented) implementation of the test step *testcase01-ts01oeCreateSystemAndEnvironment*.

6.1.1.2 testcase01-ts02oeSetClock-actActivator.outactActivator.oeSetClock

The *testcase01-ts02oeSetClock-actActivator.outactActivator.oeSetClock* has the following properties:

| TEST STEP | |
|--|--|
| <i>ts02oeSetClock</i> test the update of the current time. | |
| <i>Test Sent Message</i> | |
| TSM 1 | out:TheActor sends to system actActivator.outactActivator.oeSetClock (ACurrentClock) |
| <i>Variables</i> | |
| V 1 | TheActor:actActivator proactive actor responsible of requesting the update of the system's clock. |
| <i>Constraints</i> | |
| C 1 | TheActor is any instance existing in the current environment status. |
| C 2 | ACurrentClock is a fixed date equal to the 24th November 2017 at 15:20:00 using a 24-hours notation ¹ . |
| <i>Oracle Constraints</i> | |
| OC 1 | true for testing only the executability (is available and can be triggered) of the operation. |

The listing 6.3 provides the **Messir** (MCL-oriented) specification of the test step.

¹- Information interchange -

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 24
12  ACurrentClock.time.hour.value = 15
13  ACurrentClock.time.minute.value = 20
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.3: **Messip** (MCL-oriented) specification of the test step *testcase01-ts02oeSetClock*.

6.1.1.3 testcase01-ts03oeLogin-actAdministrator.outactAdministrator.oeLogin

The `testcase01-ts03oeLogin-actAdministrator.outactAdministrator.oeLogin` has the following properties:

| TEST STEP | |
|---|--|
| <i>ts03oeLogin</i> | |
| test the authentified access of the administrator | |
| <i>Test Sent Message</i> | <p>TSM 1 out:TheActor sends to system actAdministrator.outactAdministrator.oeLogin (<code>AdtLogin</code>, <code>AdtPassword</code>)</p> |
| <i>Variables</i> | |
| V 1 | TheActor:actAdministrator an <code>actAdministrator</code> actor as subtype of <code>actAuthenticated</code> can send <code>oeLogin</code> messages to the system. |
| <i>Constraints</i> | |
| C 1 | TheActor is any <code>actAdministrator</code> instance existing in the environment. It is thus expected that there exist at least one. |
| C 2 | <code>AdtLogin</code> has its <code>value</code> attribute equal to the primitive string 'icrashadmin' (which is the correct administrator login known by the system after the step one.) |
| C 3 | <code>AdtPassword</code> has its <code>value</code> attribute equal to the primitive string '7WXC1359' (which is the correct administrator password known by the system after the step one.) |
| <i>Oracle Constraints</i> | |
| OC 1 | the <code>AMessage</code> value is expected to be equal to the primitive string 'You are logged ! Welcome ...' |
| OC 2 | TheActor receives from system <code>ieMessage(AMessage)</code> |

The listing 6.4 provides the **Messir** (MCL-oriented) specification of the test step.

```

1  variables{
2    TheActor : actAdministrator
3    AdtLogin:dtLogin
4    AdtPassword:dtPassword
5  }
6
7
8  constraints{
9    TheActor=TheSystem.rnactAdministrator->any2(true)
10   AdtLogin.value.eq('icrashadmin')
11   AdtPassword.value.eq('7WXC1359')
12 }
13
14 oracle{
15   variables{
16     AMesssage:ptString
17   }
18   constraints{
19     AMesssage = 'You are logged ! Welcome ...'
20     TheActor.inactAdministrator.ieMessage(AMesssage)
21   }
22 }
```

Listing 6.4: **Messir** (MCL-oriented) specification of the test step *testcase01-ts03oeLogin*.

6.1.1.4 testcase01-ts04oeAddCoordinator-actAdministrator.outactAdministrator.oeAddCoordinator

The *testcase01-ts04oeAddCoordinator-actAdministrator.outactAdministrator.oeAddCoordinator* has the following properties:

| TEST STEP | |
|---|---|
| <i>ts04oeAddCoordinator</i> | |
| to test the add of a new coordinator by an administrator. | |
| <i>Test Sent Message</i> | |
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actAdministrator.outactAdministrator.oeAddCoordinator (AdtCoordinatorID, AdtLogin, AdtPassword)</p> |
| <i>Variables</i> | |
| V 1 | <p>TheActor:actAdministrator</p> <p>actAdministrator actors as being the only one allowed to add coordinators.</p> |
| <i>Constraints</i> | |
| C 1 | TheActor is any <code>actAdministrator</code> instance existing in the environment. It is expected that there exists at least one which is the same during all the test case. |
| C 2 | AdtCoordinatorID is equal to 1 to set the new coordinator ID |
| C 3 | AdtLogin has its value attribute equal to the primitive string 'steve' which is the ID defined for the new coordinator. |
| C 4 | AdtPassword has its value attribute equal to the primitive string 'pwdMessirExcalibur2017' which is the password to be set for steve. |
| <i>Oracle Constraints</i> | |

continues in next page ...

... Test Step table continuation

| | |
|------|--|
| OC 1 | the administrator should have been acknowledged for the adding of the new coordinator. |
|------|--|

The listing 6.5 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actAdministrator
4   AdtCoordinatorID : dtCoordinatorID
5   AdtLogin:dtLogin
6   AdtPassword:dtPassword
7 }
8
9 constraints{
10  TheActor = TheSystem.rnactAdministrator->any2 (true)
11  AdtCoordinatorID.value.eq('1')
12  AdtLogin.value.eq('steve')
13  AdtPassword.value.eq('pwdMessirExcalibur2017')
14 }
15
16 oracle{
17   constraints{
18     TheActor.inactAdministrator.ieCoordinatorAdded()
19   }
20 }
```

Listing 6.5: **Messir** (MCL-oriented) specification of the test step *testcase01-ts04oeAddCoordinator*.

6.1.1.5 testcase01-ts05oeLogout-actAdministrator.outactAdministrator.oeLogout

The `testcase01-ts05oeLogout-actAdministrator.outactAdministrator.oeLogout` has the following properties:

| TEST STEP | |
|--|---|
| <i>ts05oeLogout</i> | |
| to test the logout of a connected administrator. | |
| <i>Test Sent Message</i> | |
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actAdministrator.outactAdministrator.oeLogout ()</p> |
| <i>Variables</i> | |
| V 1 | <p>TheActor:actAdministrator</p> <p>an actAdministrator actor as subtype of actAuthenticated can send oeLogout messages to the system.</p> |
| <i>Constraints</i> | |
| C 1 | TheActor is any <code>actAdministrator</code> instance existing in the environment. It is expected that there exists at least one which is the same during all the test case. |
| <i>Oracle Constraints</i> | |

continues in next page ...

... Test Step table continuation

| | |
|------|--|
| OC 1 | the AMessage value is expected to be equal to the primitive string 'You are logged out ! Good Bye ...' |
| OC 2 | the administrator should have received the messahe AMessage. |

The listing 6.6 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actAdministrator
4 }
5
6 constraints{
7   TheActor = TheSystem.rnactAdministrator->any2(true)
8 }
9
10 oracle{
11   variables{
12     AMessage:ptString
13   }
14   constraints{
15     AMessage = 'You are logged out ! Good Bye ...'
16     TheActor.inactAdministrator.ieMessage(AMessage)
17   }
18 }
```

Listing 6.6: **Messip** (MCL-oriented) specification of the test step *testcase01-ts05oeLogout*.

6.1.1.6 testcase01-ts06oeSetClock02-actActivator.outactActivator.oeSetClock

The `testcase01-ts06oeSetClock02-actActivator.outactActivator.oeSetClock` has the following properties:

| TEST STEP | |
|--------------------------------------|---|
| <i>ts06oeSetClock02</i> | |
| test the update of the current time. | |
| Test Sent Message | |
| TSM 1 | out:TheActor sends to system actActivator.outactActivator.oeSetClock (ACurrentClock) |
| Variables | |
| V 1 | TheActor:icrash.environment.actActivator proactive actors responsible of requesting the update of the system's clock. |
| Constraints | |
| C 1 | TheActor is any instance existing in the current environment status. |
| C 2 | ACurrentClock is a fixed date equal to the 26th November 2017 at 10:15:00 using a 24-hours notation. |
| Oracle Constraints | |
| OC 1 | true for testing only the executability (is available and can be triggered) of the operation. |

The listing 6.7 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 15
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.7: **Messip** (MCL-oriented) specification of the test step *testcase01-ts06oeSetClock02*.

6.1.1.7 testcase01-ts07oeAlert1-actComCompany.outactComCompany.oeAlert

The `testcase01-ts07oeAlert1-actComCompany.outactComCompany.oeAlert` has the following properties:

| TEST STEP | |
|---|---|
| <i>ts07oeAlert1</i> | |
| tests the declaration of a new alert functionality. | |
| <i>Test Sent Message</i> | |
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actComCompany.outactComCompany.oeAlert (AetHumanKind, AdtDate, AdtTime, AdtPhoneNumber, AdtGPSLocation, AdtComment)</p> |
| <i>Variables</i> | |
| V 1 | <p>TheActor:actComCompany</p> <p>actComCompany actors transfer alert declaration messages.</p> |
| <i>Constraints</i> | |
| C 1 | TheActor is any instance existing in the current environment status. It is expected to exist at least one. |
| C 2 | AetHumanKind is equal to witness |
| C 3 | AdtDate is equal to the 26th of November 2017 |
| C 4 | AdtTime is equal to 10:10:16 using a 24-hours. |
| C 5 | AdtPhoneNumber is equal to the ptString value '+3524666445252'. |
| C 6 | AdtGPSLocation is equal to (49.627675 , 6.159590). |
| C 7 | AdtComment is equal to '3 cars involved in an accident.' |

continues in next page ...

... Test Step table continuation

| <i>Oracle Constraints</i> | |
|---------------------------|--|
| OC 1 | AdtSMS is equal to the ptString 'Your alert has been registered. We will handle it and keep you informed'. |
| OC 2 | AdtSMS is sent to the phone number AdtPhoneNumber using the communication company having sent the alert using its ieSmsSend input message. |

The listing 6.8 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actComCompany
4   AetHumanKind:eHumanKind
5   AdtDate:dtDate
6   AdtTime:dtTime
7   AdtPhoneNumber:dtPhoneNumber
8   AdtGPSLocation:dtGPSLocation
9   AdtComment:dtComment
10 }
11
12 constraints{
13   TheActor = TheSystem.rnactComCompany->any2(true)
14   AetHumanKind = witness
15   AdtDate.year.value = 2017
16   AdtDate.month.value = 11
17   AdtDate.day.value = 26
18   AdtTime.hour.value = 10
19   AdtTime.minute.value = 10
20   AdtTime.second.value = 16
21   AdtPhoneNumber.value = '+3524666445252'
22   AdtGPSLocation.latitude.value = 49.627675
23   AdtGPSLocation.longitude.value = 6.159590
24   AdtComment.value = '3 cars involved in an accident.'
25 }
26
27 oracle{
28   variables{
29     AdtSMS:dtSMS
30   }
31   constraints{
32     AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
33     TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
34   }
35 }
```

Listing 6.8: **Messir** (MCL-oriented) specification of the test step *testcase01-ts07oeAlert1*.

6.1.1.8 testcase01-ts08oeSetClock03-actActivator.outactActivator.oeSetClock

The `testcase01-ts08oeSetClock03-actActivator.outactActivator.oeSetClock` has the following properties:

| TEST STEP |
|--------------------------------------|
| <i>ts08oeSetClock03</i> |
| test the update of the current time. |
| <i>Test Sent Message</i> |

continues in next page ...

... Test Step table continuation

| | |
|---------------------------|---|
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actActivator.outactActivator.oeSetClock (ACurrentClock)</p> |
| Variables | |
| V 1 | TheActor:actActivator proactive actor responsible of requesting the update of the system's clock. |
| Constraints | |
| C 1 | TheActor is any instance existing in the current environment status. |
| C 2 | ACurrentClock is a fixed date equal to the 26th November 2017 at 10:30:00 using a 24-hours notation. |
| Oracle Constraints | |
| OC 1 | true for testing only the executability (is available and can be triggered) of the operation. |

The listing 6.9 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 30
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.9: **Messip** (MCL-oriented) specification of the test step *testcase01-ts08oeSetClock03*.

6.1.1.9 testcase01-ts09oeSollicitateCrisisHandling-actActivator.outactActivator.oeSollicitateCrisis

The *testcase01-ts09oeSollicitateCrisisHandling-actActivator.outactActivator.oeSollicitateCrisis* has the following properties:

| TEST STEP |
|--|
| <i>ts09oeSollicitateCrisisHandling</i> |
| test the proactive sollication to handle an alert. |
| <i>Test Sent Message</i> |

continues in next page ...

... Test Step table continuation

| | |
|---------------------------|---|
| TSM 1 | out:TheActor sends to system actActivator.outactActivator.oeSollicitateCrisisHandling () |
| Variables | |
| V 1 | TheActor:icrash.environment.actActivator proactive actor responsible of triggering sollicitation functionality. |
| Constraints | |
| C 1 | TheActor is any instance existing in the current environment status. It is expected to exist at least one. |
| Oracle Variables | |
| OV 1 | TheAdministrator:actAdministrator actAdministrator actors can be sollicitated to handle alerts. |
| OV 2 | TheCoordinator:actCoordinator actCoordinator actors can be sollicitated to handle alerts. |
| OV 3 | AMessageForCrisisHandlers:ptString messages sent to sollicitated actors are of type ptString. |
| Oracle Constraints | |
| OC 1 | TheAdministrator is any instance existing in the current environment status. It is expected to exist at least one. |
| OC 2 | TheCoordinator is any instance existing in the current environment status. It is expected to exist at least one. |
| OC 3 | AMessageForCrisisHandlers is equal to the ptString 'There are alerts pending since more than the defined delay. Please REACT !' |
| OC 4 | TheCoordinator and TheAdministrator have received the message AMessageForCrisisHandlers. |

The listing 6.10 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actActivator
4 }
5
6 constraints{
7   TheActor = TheSystem.rnactActivator->any2(true)
8 }
9
10 oracle{
11   variables{
12     TheAdministrator:actAdministrator
13     TheCoordinator:actCoordinator
14     AMessipForCrisisHandlers:ptString
15   }
16   constraints{
17     TheAdministrator = TheSystem.rnactAdministrator->any2(true)
18     TheCoordinator = TheSystem.rnactCoordinator->any2(true)
19     AMessipForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
      REACT !'
20   TheAdministrator.inactAdministrator.ieMessage(AMessipForCrisisHandlers)

```

```

21     TheCoordinator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)
22 }
23 }
```

Listing 6.10: **Messir** (MCL-oriented) specification of the test step *testcase01-ts09oeSollicitateCrisisHandling*.

6.1.1.10 testcase01-ts10oeLogin02-actAuthenticated.outactAuthenticated.oeLogin

The *testcase01-ts10oeLogin02-actAuthenticated.outactAuthenticated.oeLogin* has the following properties:

| TEST STEP | |
|---|--|
| <i>ts10oeLogin02</i> | |
| test the authentified access of the coordinator | |
| <i>Test Sent Message</i> | |
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actAuthenticated.outactAuthenticated.oeLogin (<i>AdtLogin</i>, <i>AdtPassword</i>)</p> |
| <i>Variables</i> | |
| V 1 | <p>TheActor:actCoordinator</p> <p>an <i>actCoordinator</i> actor as subtype of <i>actAuthenticated</i> can send <i>oeLogin</i> messages to the system.</p> |
| <i>Constraints</i> | |
| C 1 | TheActor is any <i>actAdministrator</i> instance existing in the environment. It is thus expected that there exist at least one. |
| C 2 | <i>AdtLogin</i> has its <i>value</i> attribute equal to the primitive string 'icrashadmin' (which is the correct administrator login known by the system after the step one.) |
| C 3 | <i>AdtPassword</i> has its <i>value</i> attribute equal to the primitive string '7WXC1359' (which is the correct administrator password known by the system after the step one.) |
| <i>Oracle Constraints</i> | |
| OC 1 | the <i>AMessage</i> value is expected to be equal to the primitive string 'You are logged ! Welcome ...' |

The listing 6.11 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtLogin:dtLogin
5   AdtPassword:dtPassword
6 }
7
8 constraints{
9   TheActor = TheSystem.rnactCoordinator->select(a | a.rnctCoordinator.login.value.eq('steve'))->any2
10  (true)
11  AdtLogin.value.eq('steve')
11  AdtPassword.value.eq('pwdMessirExcalibur2017')
```

```

12 }
13
14 oracle{
15   variables{
16     AMessage:ptString
17   }
18   constraints{
19     AMessage = 'You are logged ! Welcome ...'
20     TheActor.inactAuthenticated.ieMessage(AMessage)
21   }
22 }
```

Listing 6.11: **Messip** (MCL-oriented) specification of the test step *testcase01-ts10oeLogin02*.

6.1.1.11 testcase01-ts11oeGetCrisisSet-actCoordinator.outactCoordinator.oeGetCrisisSet

The *testcase01-ts11oeGetCrisisSet-actCoordinator.outactCoordinator.oeGetCrisisSet* has the following properties:

| TEST STEP | |
|---------------------------|---|
| <i>ts11oeGetCrisisSet</i> | |
| cf. actor documentation | |
| <i>Test Sent Message</i> | |
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p style="color: blue;">actCoordinator.outactCoordinator.oeGetCrisisSet (AetCrisisStatus)</p> |
| <i>Variables</i> | |
| V 1 | TheActor:icrash.environment.actCoordinator cf. actor documentation |
| V 2 | AetCrisisStatus:icrash.concepts.primarytypes.datatypes.etCrisisStatus cf. actor documentation |
| V 3 | ActCrisis:icrash.concepts.primarytypes.classes.ctCrisis cf. actor documentation |
| <i>Constraints</i> | |
| C 1 | TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value |
| C 2 | AetCrisisStatus value is pending |
| <i>Oracle Constraints</i> | |
| OC 1 | ActCrisis is any ctCrisis instance that has been sent to TheActor. |

The listing 6.12 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AetCrisisStatus : etCrisisStatus
5 }
6
7 constraints{
```

```

8   TheActor=TheSystem.rnactCoordinator
9       ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10      ->any2(true)
11  ActCrisisStatus = pending
12 }
13
14 oracle{
15   variables{
16     ActCrisis:ctCrisis
17   }
18   constraints{
19     TheActor.inactCoordinator.ieSendACrisis(ActCrisis)
20   }
21 }
```

Listing 6.12: **Messir** (MCL-oriented) specification of the test step *testcase01-ts11oeGetCrisisSet*.

6.1.1.12 testcase01-ts12oeSetCrisisHandler-actCoordinator.outactCoordinator.oeSetCrisisHandler

The *testcase01-ts12oeSetCrisisHandler-actCoordinator.outactCoordinator.oeSetCrisisHandler* has the following properties:

| TEST STEP | |
|-------------------------------|--|
| <i>ts12oeSetCrisisHandler</i> | |
| cf. actor documentation | |
| <i>Test Sent Message</i> | |
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actCoordinator.outactCoordinator.oeSetCrisisHandler (AdtCrisisID)</p> |
| <i>Variables</i> | |
| V 1 | TheActor:icrash.environment.actCoordinator cf. actor documentation |
| V 2 | TheComCompany:icrash.environment.actComCompany cf. actor documentation |
| V 3 | TheCoordinator:icrash.environment.actCoordinator cf. actor documentation |
| V 4 | AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID cf. actor documentation |
| V 5 | AMessage:lu.uni.lassy.messir.libraries.primitives.ptString cf. actor documentation |
| V 6 | AdtPhoneNumber:icrash.concepts.primarytypes.datatypes.dtPhoneNumber cf. actor documentation |
| V 7 | AdtSMS:icrash.concepts.secondarytypes.datatypes.dtSMS cf. actor documentation |
| V 8 | ActAlert:icrash.concepts.primarytypes.classes.ctAlert cf. actor documentation |
| <i>Constraints</i> | |
| C 1 | TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value |
| C 2 | AdtCrisisID as a value of 1 |

continues in next page ...

... Test Step table continuation

| | |
|---------------------------|---|
| C 3 | AMessage is the string 'You are now considered as handling the crisis !' |
| C 4 | AdtPhoneNumber |
| C 5 | AdtSMS has for value the string 'The handling of your alert by our services is in progress !' |
| Oracle Constraints | |
| OC 1 | there is a communication company actor that received the message ieSmsSend(AdtPhoneNumber,AdtSMS) |
| OC 2 | there is a coordinator actor that received an alert using the message ieSendAnAlert(ActAlert) |

The listing 6.13 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactCoordinator
9     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10    ->any2(true)
11 }
12
13 oracle{
14   variables{
15     AMessage:ptString
16     AdtPhoneNumber:dtPhoneNumber
17     AdtSMS:dtSMS
18     ActAlert:ctAlert
19     TheComCompany: actComCompany
20     TheCoordinator:actCoordinator
21   }
22   constraints{
23     AMessage = 'You are now considered as handling the crisis !'
24     AdtSMS.value = 'The handling of your alert by our services is in progress !'
25     TheComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
26     TheCoordinator.inactCoordinator.ieSendAnAlert(ActAlert)
27     TheActor.inactAuthenticated.ieMessage(AMessage)
28   }
29 }
```

Listing 6.13: **Messip** (MCL-oriented) specification of the test step *testcase01-ts12oeSetCrisisHandler*.

6.1.1.13 testcase01-ts13oeSetClock04-actActivator.outactActivator.oeSetClock

The *testcase01-ts13oeSetClock04-actActivator.outactActivator.oeSetClock* has the following properties:

| TEST STEP |
|--------------------------|
| <i>ts13oeSetClock04</i> |
| cf. actor documentation |
| <i>Test Sent Message</i> |

continues in next page ...

... Test Step table continuation

| | |
|--------------------|---|
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actActivator.outactActivator.oeSetClock (ACurrentClock)</p> |
| Variables | |
| V 1 | TheActor:icrash.environment.actActivator cf. actor documentation |
| V 2 | ACurrentClock:lu.uni.lassy.messir.libraries.calendar.dtDateAndTime cf. actor documentation |
| Constraints | |
| C 1 | TheActor |
| C 2 | ACurrentClock |

The listing 6.14 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 45
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.14: **Messir** (MCL-oriented) specification of the test step *testcase01-ts13oeSetClock04*.

6.1.1.14 testcase01-ts14oeValidateAlert-actCoordinator.outactCoordinator.oeValidateAlert

The *testcase01-ts14oeValidateAlert-actCoordinator.outactCoordinator.oeValidateAlert* has the following properties:

| |
|---|
| TEST STEP |
| <i>ts14oeValidateAlert</i> cf. actor documentation |
| <i>Test Sent Message</i> |

continues in next page ...

... Test Step table continuation

| | |
|---------------------------|---|
| TSM 1 | out: TheActor sends to system actCoordinator.outactCoordinator.oeValidateAlert (AdtAlertID) |
| <i>Variables</i> | |
| V 1 | TheActor: icrash.environment.actCoordinator cf. actor documentation |
| V 2 | AdtAlertID: icrash.concepts.primarytypes.datatypes.dtAlertID cf. actor documentation |
| V 3 | AMessage: lu.uni.lassy.messir.libraries.primitives.ptString cf. actor documentation |
| <i>Constraints</i> | |
| C 1 | TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value |
| C 2 | AdtAlertID |
| C 3 | AMessage |
| <i>Oracle Constraints</i> | |
| OC 1 | |

The listing 6.15 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtAlertID : dtAlertID
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactCoordinator
9     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10    ->any2(true)
11 }
12
13 oracle{
14   variables{
15     AMessage:ptString
16   }
17   constraints{
18     AMessage = 'The Alert is now declared as valid !'
19     TheActor.actAuthenticated.inactAuthenticated.ieMessage(AMessage)
20   }
21 }
```

Listing 6.15: **Messir** (MCL-oriented) specification of the test step *testcase01-ts14oeValidateAlert*.

6.1.1.15 testcase01-ts15oeAlert2-actComCompany.outactComCompany.oeAlert

The *testcase01-ts15oeAlert2-actComCompany.outactComCompany.oeAlert* has the following properties:

| TEST STEP | |
|--|---|
| <i>ts15oeAlert2</i> cf. actor documentation | |
| Test Sent Message | |
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actComCompany.outactComCompany.oeAlert (AetHumanKind, AdtDate, AdtTime, AdtPhoneNumber, AdtGPSLocation, AdtComment)</p> |
| Variables | |
| V 1 | TheActor:icrash.environment.actComCompany cf. actor documentation |
| V 2 | AetHumanKind:icrash.concepts.primarytypes.datatypes.etHumanKind cf. actor documentation |
| V 3 | AdtDate:lu.uni.lassy.messir.libraries.calendar.dtDate cf. actor documentation |
| V 4 | AdtTime:lu.uni.lassy.messir.libraries.calendar.dtTime cf. actor documentation |
| V 5 | AdtPhoneNumber:icrash.concepts.primarytypes.datatypes.dtPhoneNumber cf. actor documentation |
| V 6 | AdtGPSLocation:icrash.concepts.primarytypes.datatypes.dtGPSLocation cf. actor documentation |
| V 7 | AdtComment:icrash.concepts.primarytypes.datatypes.dtComment cf. actor documentation |
| V 8 | AdtSMS:icrash.concepts.secondarytypes.datatypes.dtSMS cf. actor documentation |
| Constraints | |
| C 1 | TheActor |
| C 2 | AetHumanKind |
| C 3 | AdtDate |
| C 4 | AdtTime |
| C 5 | AdtPhoneNumber |
| C 6 | AdtGPSLocation |
| C 7 | AdtComment |
| C 8 | AdtSMS |
| Oracle Constraints | |
| OC 1 | |

The listing 6.16 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actComCompany
4   AetHumanKind:etHumanKind
5   AdtDate:dtDate
6   AdtTime:dtTime

```

```

7 AdtPhoneNumber:dtPhoneNumber
8 AdtGPSLocation:dtGPSLocation
9 AdtComment:dtComment
10 }
11
12 constraints{
13   TheActor = TheSystem.rnactComCompany->any2(true)
14   AetHumanKind = witness
15   AdtDate.year.value = 2017
16   AdtDate.month.value = 11
17   AdtDate.day.value = 26
18   AdtTime.hour.value = 10
19   AdtTime.minute.value = 20
20   AdtTime.second.value = 00
21   AdtPhoneNumber.value = '+3524666445000'
22   AdtGPSLocation.latitude.value = 49.627095
23   AdtGPSLocation.longitude.value = 6.160251
24   AdtComment.value = 'A car crash just happened.'
25 }
26
27 oracle{
28   variables{
29     AdtSMS:dtSMS
30   }
31   constraints{
32     AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
33     TheActor.actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
34   }
35 }

```

Listing 6.16: **Messir** (MCL-oriented) specification of the test step *testcase01-ts15oeAlert2*.

6.1.1.16 testcase01-ts16oeSetClock05-actActivator.outactActivator.oeSetClock

The `testcase01-ts16oeSetClock05-actActivator.outactActivator.oeSetClock` has the following properties:

| TEST STEP | |
|--------------------------|---|
| ts16oeSetClock05 | |
| cf. actor documentation | |
| Test Sent Message | |
| TSM 1 | out:TheActor sends to system actActivator.outactActivator.oeSetClock (ACurrentClock) |
| Variables | |
| V 1 | TheActor:icrash.environment.actActivator cf. actor documentation |
| V 2 | ACurrentClock:lu.uni.lassy.messir.libraries.calendar.dtDateAndTime cf. actor documentation |
| Constraints | |
| C 1 | TheActor |
| C 2 | ACurrentClock |

The listing 6.17 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 12
13  ACurrentClock.time.minute.value = 45
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.17: **Messir** (MCL-oriented) specification of the test step *testcase01-ts16oeSetClock05*.

6.1.1.17 testcase01-ts17oeSetCrisisStatus-actCoordinator.outactCoordinator.oeSetCrisisStatus

The *testcase01-ts17oeSetCrisisStatus-actCoordinator.outactCoordinator.oeSetCrisisStatus* has the following properties:

| TEST STEP | |
|------------------------------|---|
| <i>ts17oeSetCrisisStatus</i> | |
| cf. actor documentation | |
| <i>Test Sent Message</i> | |
| TSM 1 | <p>out:TheActor</p> <p>sends to system</p> <p>actCoordinator.outactCoordinator.oeSetCrisisStatus (AdtCrisisID, AetCrisisStatus)</p> |
| <i>Variables</i> | |
| V 1 | TheActor:icrash.environment.actCoordinator cf. actor documentation |
| V 2 | AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID cf. actor documentation |
| V 3 | AetCrisisStatus:icrash.concepts.primarytypes.datatypes.etCrisisStatus cf. actor documentation |
| V 4 | AMessage:lu.uni.lassy.messir.libraries.primitives.ptString cf. actor documentation |
| <i>Constraints</i> | |
| C 1 | TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value |
| C 2 | AdtCrisisID |

continues in next page ...

... Test Step table continuation

| | |
|---------------------------|-----------------|
| C 3 | AetCrisisStatus |
| C 4 | AMessage |
| Oracle Constraints | |
| OC 1 | |

The listing 6.18 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5   AetCrisisStatus : etCrisisStatus
6 }
7
8 constraints{
9   TheActor=TheSystem.rnactCoordinator
10   ->select(a | a.rnctCoordinator.login.value.eq('steve'))
11   ->any2(true)
12 }
13
14 oracle{
15   variables{
16     AMessage:ptString
17   }
18   constraints{
19     AMessage = 'The crisis status has been updated !'
20     TheActor.inactAuthenticated.ieMessage(AMessage)
21   }
22 }
```

Listing 6.18: **Messip** (MCL-oriented) specification of the test step *testcase01-ts17oeSetCrisisStatus*.

6.1.1.18 testcase01-ts18oeReportOnCrisis-actCoordinator.outactCoordinator.oeReportOnCrisis

The *testcase01-ts18oeReportOnCrisis-actCoordinator.outactCoordinator.oeReportOnCrisis* has the following properties:

| TEST STEP | |
|-----------------------------|---|
| <i>ts18oeReportOnCrisis</i> | |
| cf. actor documentation | |
| <i>Test Sent Message</i> | |
| TSM 1 | out:TheActor sends to system actCoordinator.outactCoordinator.oeReportOnCrisis (AdtCrisisID , AdtComment) |
| <i>Variables</i> | |
| V 1 | TheActor:icrash.environment.actCoordinator cf. actor documentation |
| V 2 | AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID |

continues in next page ...

... Test Step table continuation

| | |
|---------------------------|---|
| V 3 | cf. actor documentation AdtComment:icrash.concepts.primarytypes.datatypes.dtComment |
| V 4 | cf. actor documentation AMessage:lu.uni.lassy.messir.libraries.primitives.ptString cf. actor documentation |
| Constraints | |
| C 1 | TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value |
| C 2 | AdtCrisisID |
| C 3 | AdtComment |
| C 4 | AMessage |
| Oracle Constraints | |
| OC 1 | |

The listing 6.19 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5   AdtComment : dtComment
6 }
7
8 constraints{
9   TheActor=TheSystem.rnactCoordinator
10    ->select(a | a.rnctCoordinator.login.value.eq('steve'))
11    ->any2(true)
12 }
13
14 oracle{
15   variables{
16     AMessage:ptString
17   }
18   constraints{
19     AMessage = 'The crisis comment has been updated !'
20     TheActor.inactAuthenticated.ieMessage(AMessage)
21   }
22 }
```

Listing 6.19: **Messir** (MCL-oriented) specification of the test step *testcase01-ts18oeReportOnCrisis*.

6.1.1.19 testcase01-ts19oeCloseCrisis-actCoordinator.outactCoordinator.oeCloseCrisis

The *testcase01-ts19oeCloseCrisis-actCoordinator.outactCoordinator.oeCloseCrisis* has the following properties:

| TEST STEP |
|--------------------------|
| <i>ts19oeCloseCrisis</i> |
| cf. actor documentation |
| <i>Test Sent Message</i> |

continues in next page ...

... Test Step table continuation

| | |
|---------------------------|--|
| TSM 1 | out: TheActor sends to system actCoordinator.outactCoordinator.oeCloseCrisis (AdtCrisisID) |
| <i>Variables</i> | |
| V 1 | TheActor: icrash.environment.actCoordinator cf. actor documentation |
| V 2 | AdtCrisisID: icrash.concepts.primarytypes.datatypes.dtCrisisID cf. actor documentation |
| V 3 | AMessage: lu.uni.lassy.messir.libraries.primitives.ptString cf. actor documentation |
| <i>Constraints</i> | |
| C 1 | TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value |
| C 2 | AdtCrisisID |
| C 3 | AMessage |
| <i>Oracle Constraints</i> | |
| OC 1 | |

The listing 6.20 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactCoordinator
9     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10    ->any2(true)
11 }
12
13 oracle{
14   variables{
15     AMessage:ptString
16   }
17   constraints{
18     AMessage = 'The crisis is now closed !'
19     TheActor.inactAuthenticated.ieMessage(AMessage)
20   }
21 }
```

Listing 6.20: **Messir** (MCL-oriented) specification of the test step *testcase01-ts19oeCloseCrisis*.

6.1.2 Test Case Instance - instance01

6.1.3 Test Case Instance - instance01Part01

Figure 6.1 Sequence diagram representing the first part of a simple and complete testcase instance for *iCrash*.

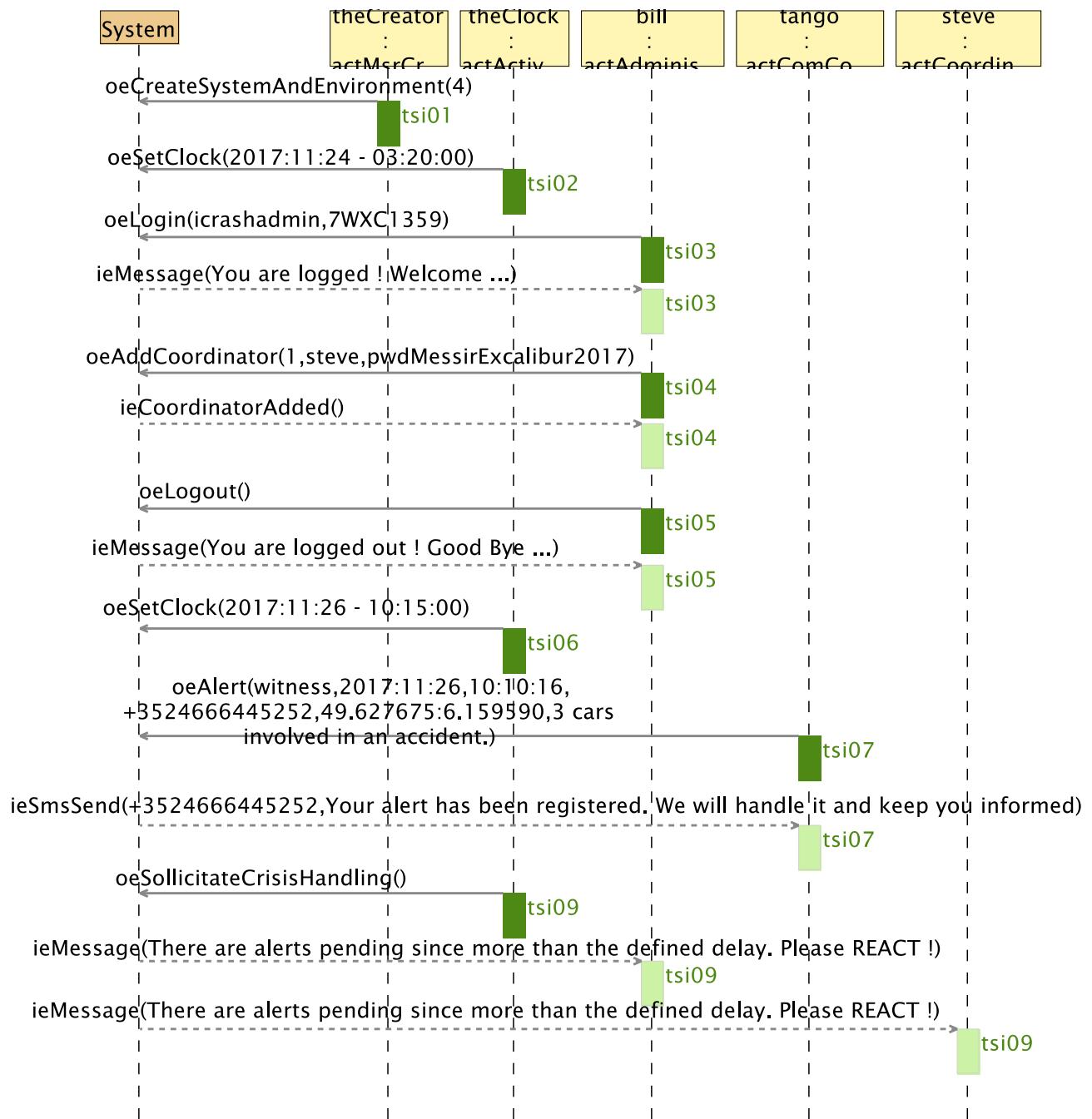


Figure 6.1: tci-testcase01-instance01-Part01 testcase instance sequence diagram

6.1.4 Test Case Instance - instance01Part02

Figure 6.2 Sequence diagram representing the second part of a simple and complete testcase instance for *iCrash*.

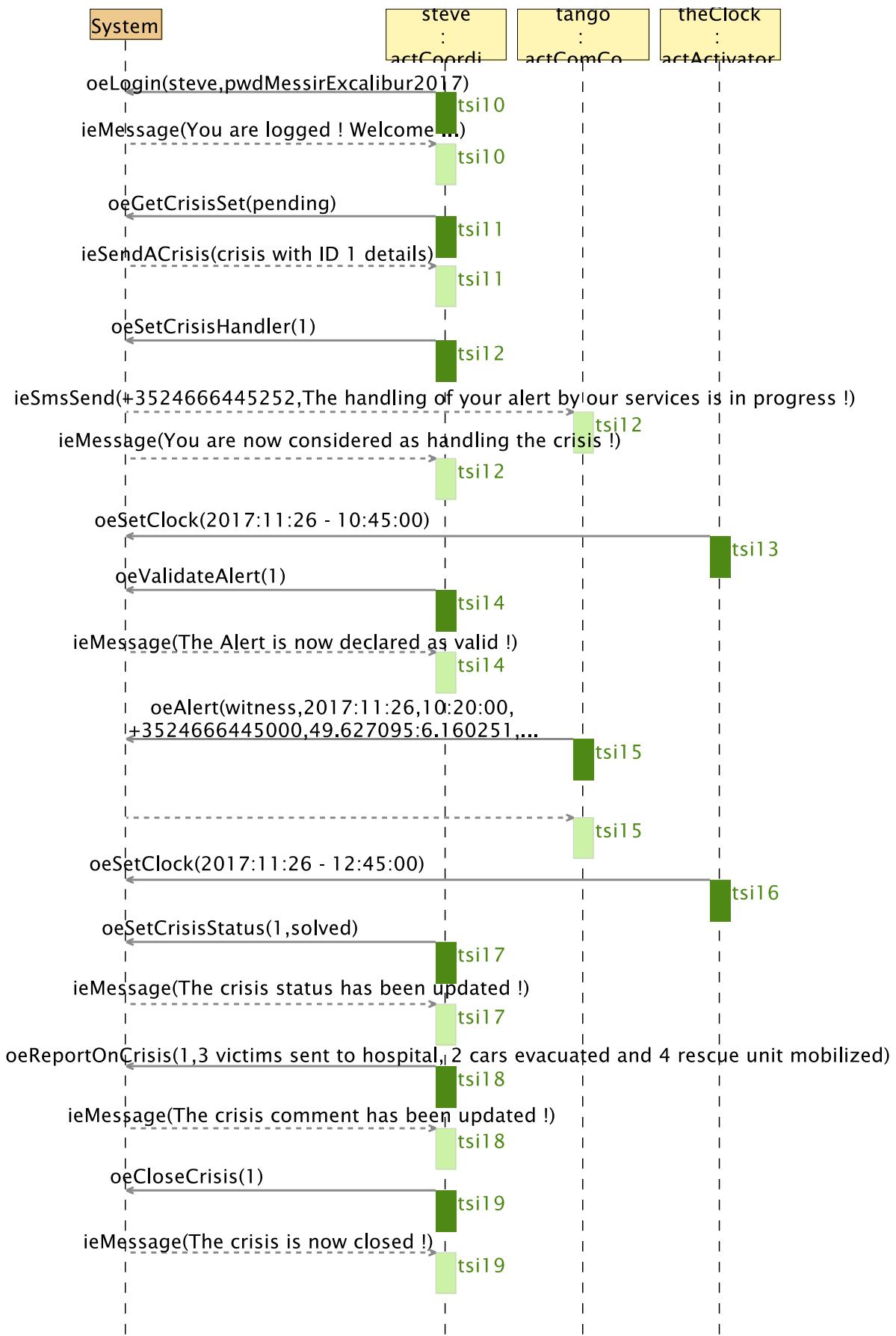


Figure 6.2: tci-testcase01-instance01-Part02 testcase instance sequence diagram

Chapter 7

Additional Constraints

7.1 Quality Constraints

Description of all the constraints that concern the required quality criteria according to their ISO definition [?].

7.1.1 Functional suitability

Constraints on the degree to which the product provides functions that meet stated and implied needs when the product is used under specified conditions.

7.1.1.1 Functional completeness

List of requirements on the degree to which the set of functions covers all the specified tasks and user objectives.

1. (to be filled)

7.1.1.2 Functional correctness

List of requirements on the degree to which the set of functions covers all the specified tasks and user objectives.

1. (to be filled)

7.1.1.3 Functional appropriateness

List of requirements on the degree to which the functions facilitate the accomplishment of specified tasks and objectives.

1. (to be filled)

7.1.2 Performance efficiency

Constraints on the performance relative to the amount of resources used under stated conditions

7.1.2.1 Time behaviour

List of requirements on the degree to which the response and processing times and throughput rates of a product or system, when performing its functions, meet requirements.

1. (to be filled)

7.1.2.2 Resource utilization

List of requirements on the degree to which the amounts and types of resources used by a product or system, when performing its functions, meet requirements.

1. (to be filled)

7.1.2.3 Capacity

List of requirements on the degree to which the maximum limits of a product or system parameter meet requirements.

1. (to be filled)

7.1.3 Compatibility

Constraints on the degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment.

7.1.3.1 Co-existence

List of requirements on the degree to which a product can perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other product.

1. (to be filled)

7.1.3.2 Interoperability

List of requirements on the degree to which two or more systems, products or components can exchange information and use the information that has been exchanged.

1. (to be filled)

7.1.4 Usability

Constraints on the usability degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

7.1.4.1 Appropriateness recognizability

List of requirements on the degree to which users can recognize whether a product or system is appropriate for their needs.

1. (to be filled)

7.1.4.2 Learnability

List of requirements on the degree to which a product or system can be used by specified users to achieve specified goals of learning to use the product or system with effectiveness, efficiency, freedom from risk and satisfaction in a specified context of use.

1. (to be filled)

7.1.4.3 Operability

List of requirements on the degree to which a product or system has attributes that make it easy to operate and control.

1. (to be filled)

7.1.4.4 User error protection

List of requirements on the degree to which a system protects users against making errors.

1. (to be filled)

7.1.4.5 User interface aesthetics

List of requirements on the degree to which a user interface enables pleasing and satisfying interaction for the user.

1. (to be filled)

7.1.4.6 Accessibility

List of requirements on the degree to which a product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use.

1. (to be filled)

7.1.5 Reliability

Constraints on the degree to which a system, product or component performs specified functions under specified conditions for a specified period of time.

7.1.5.1 Maturity

List of requirements on the degree to which a system, product or component meets needs for reliability under normal operation.

1. (to be filled)

7.1.5.2 Availability

List of requirements on the degree to which a system, product or component is operational and accessible when required for use.

1. (to be filled)

7.1.5.3 Fault tolerance

List of requirements on the degree to which a system, product or component operates as intended despite the presence of hardware or software faults.

1. (to be filled)

7.1.5.4 Recoverability

List of requirements on the degree to which, in the event of an interruption or a failure, a product or system can recover the data directly affected and re-establish the desired state of the system.

1. (to be filled)

7.1.6 Security

Constraints on the degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization.

7.1.6.1 Confidentiality

List of requirements on the degree to which a product or system ensures that data are accessible only to those authorized to have access.

1. (to be filled)

7.1.6.2 Integrity

List of requirements on the degree to which a system, product or component prevents unauthorized access to, or modification of, computer programs or data.

1. (to be filled)

7.1.6.3 Non-repudiation

List of requirements on the degree to which actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later.

1. (to be filled)

7.1.6.4 Accountability

List of requirements on the degree to which the actions of an entity can be traced uniquely to the entity.

1. (to be filled)

7.1.6.5 Authenticity

List of requirements on the degree to which the identity of a subject or resource can be proved to be the one claimed.

1. (to be filled)

7.1.7 Maintainability

Constraints on the degree of effectiveness and efficiency with which a product or system can be modified by the intended maintainers.

7.1.7.1 Modularity

List of requirements on the degree to which a system or computer program is composed of discrete components such that a change to one component has minimal impact on other components.

1. (to be filled)

7.1.7.2 Reusability

List of requirements on the degree to which an asset can be used in more than one system, or in building other assets.

1. (to be filled)

7.1.7.3 Analysability

List of requirements on the degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified.

1. (to be filled)

7.1.7.4 Modifiability

List of requirements on the degree to which a product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality.

1. (to be filled)

7.1.7.5 Testability

List of requirements on the degree of effectiveness and efficiency with which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met.

1. (to be filled)

7.1.8 Portability

Constraints on the degree of effectiveness and efficiency with which a system, product or component can be transferred from one hardware, software or other operational or usage environment to another.

7.1.8.1 Adaptability

List of requirements on the degree to which a product or system can effectively and efficiently be adapted for different or evolving hardware, software or other operational or usage environments.

1. (to be filled)

7.1.8.2 Installability

List of requirements on the degree of effectiveness and efficiency with which a product or system can be successfully installed and/or uninstalled in a specified environment.

1. (to be filled)

7.1.8.3 Replaceability

List of requirements on the degree to which a product can replace another specified software product for the same purpose in the same environment.

1. (to be filled)

7.2 Other Constraints

Any other unclassified constraints judged as required for the product under development.

Appendix A

Undocumented Messir Specification Elements

A.1 Undocumented Use Case Instances

A.1.1 Undocumented Summary Level Use Case Instances

- icrash.usecases.suDeployAndRun.uciSimpleAndCompletePart03

A.1.2 Undocumented User-Goal Level Use Case Instances

- usecases.uciugSecurelyUseSystem.uciugSecurelyUseSystem

A.1.3 Undocumented Use Case Instance Views

- uci-uciugSecurelyUseSystem

A.2 Undocumented Concept Model Views

- cm-pt-dt-lv-02-dtGPSLocation

A.3 Undocumented Test-Case Instance Specifications

- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01
- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01Part01
- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01Part02

Appendix B

Specification project
`lu.uni.lassy.excalibur.examples.icrash`

B.1 Use Cases Model

This section contains the use cases elicited during the requirements elicitation phase. The use cases are textually described as suggested by the **Messir** method and inspired by the standard Cokburn template [?].

B.1.1 Use Cases

B.1.1.1 subfunction-oeCloseCrisis

the actCoordinator's goal is to declare a crisis as closed.

| USE-CASE DESCRIPTION | |
|---|--|
| Name | oeCloseCrisis |
| Scope | system |
| Level | subfunction |
| <i>Primary actor(s)</i> | |
| 1 | actCoordinator[active] |
| <i>Goal(s) description</i> | |
| the actCoordinator's goal is to declare a crisis as closed. | |
| <i>Protocol condition(s)</i> | |
| 1 | the iCrash system has been deployed. |
| <i>Pre-condition(s)</i> | |
| 1 | none |
| <i>Main post-condition(s)</i> | |
| 1 | the crisis is known by the system to be closed. |
| 2 | a message ieMessage(AMessage) is sent to the actCoordinator to inform him that his crisis is now considered as closed. |

Figure B.1 shows the use case diagram for the oeCloseCrisis subfunction use case

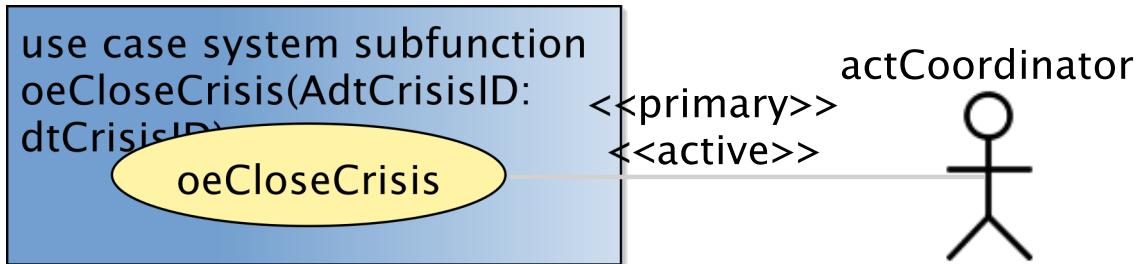


Figure B.1: oeCloseCrisis subfunction use case

Appendix C

Messir Specification Files Listing

C.1 File ./src-gen/messir-spec/.views.msr

```
1 //  
2 //DON'T TOUCH THIS FILE !!!  
3 //  
4 package uuid7e0d382938204f3c9036c123484468fb {  
5   Concept Model {}  
6 }
```

Listing C.1: Messir Spec. file .views.msr.

C.2 File ./src-gen/messir-spec/operations/concepts/secondarytypes-datatatypes/dtSMS.msr

```
1 package icrash.operations.concepts.secondarytypes.datatypes.dtSMS{  
2  
3 import lu.uni.lassy.messir.libraries.primitives  
4 import lu.uni.lassy.messir.libraries.calendar  
5 import lu.uni.lassy.messir.libraries.math  
6  
7 import icrash.concepts.primarytypes.datatypes  
8 import icrash.concepts.primarytypes.classes  
9 import icrash.concepts.secondarytypes.datatypes  
10 import icrash.concepts.secondarytypes.classes  
11  
12 Operation Model {  
13 operation: icrash.concepts.secondarytypes.datatypes.dtSMS.is():ptBoolean{  
14   postF{  
15     let TheResult: ptBoolean in  
16     let MaxLength: ptInteger in  
17     ( if  
18       ( MaxLength = 160  
19         and AdtValue.value.length().leq(MaxLength)  
20       )  
21     then (TheResult = true)  
22     else (TheResult = false)  
23     endif  
24     result = TheResult  
25   }  
26 prolog{ "src/Operations/Concepts/SecondaryTypesDatatypes/SecondaryTypesDatatypes-dtSMS-is.pl"}  
27 }  
28 }  
29 }
```

Listing C.2: Messir Spec. file dtSMS.msr.

C.3 File ./src-gen/messir-spec/operations/environment/environment-actActivator-oeSetClock.msr

```

1 package icrash.operations.environment.actActivator.oeSetClock {
2
3 import icrash.environment
4
5 import lu.uni.lassy.messir.libraries.primitives
6 import lu.uni.lassy.messir.libraries.calendar
7 import lu.uni.lassy.messir.libraries.math
8
9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11
12 Operation Model {
13
14 operation: actActivator.outactActivator.oeSetClock(AcurrentClock:dtDateAndTime) :ptBoolean
15 {
16 preP{
17 let TheSystem: ctState in
18 let AvpStarted: ptBoolean in
19
20 /* PreP01 */
21 self.rnActor.rnSystem = TheSystem
22 and self.rnActor.rnSystem.vpStarted = AvpStarted
23 and AvpStarted = true
24 and TheSystem.clock.lt(AcurrentClock)
25 }
26 preF{true}
27
28 postF{
29 let TheSystem: ctState in
30 self.rnActor.rnSystem = TheSystem
31
32 /* PostF01 */
33 and TheSystem@post.clock = AcurrentClock
34 }
35 postP{true}
36
37 prolog{"src/Operations/Environment/OUT/outactActivator-oeSetClock.pl"}
38
39 }
40 }
41 }
```

Listing C.3: Messir Spec. file environment-actActivator-oeSetClock.msr.

C.4 File ./src-gen/messir-spec/operations/environment/environment-actActivator-oeSollicitateCrisisHandling.msr

```

1 package icrash.operations.environment.actActivator.oeSollicitateCrisisHandling {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.concepts.primarytypes.classes
10 import icrash.environment
11
12 Operation Model {
13
14 operation: actActivator.outactActivator.oeSollicitateCrisisHandling():ptBoolean
15 {
16 preP{
17 let TheSystem: ctState in
```

```

18 let AvpStarted: ptBoolean in
19 let ColctCrisisToHandle:
20     Bag(ctCrisis) in
21
22 self.rnActor.rnSystem = TheSystem
23
24 /* PreP01 */
25 and TheSystem.vpStarted
26
27 /* PreP02 */
28 and TheSystem.rnctCrisis->select(handlingDelayPassed())
29     = ColctCrisisToHandle
30 and ColctCrisisToHandle->size().geq(1)
31 }
32 preF{true}
33
34 postF{
35 let TheSystem: ctState in
36 let AMessageForCrisisHandlers: dtComment in
37 let ColctCrisisToAllocateIfPossible:Bag(ctCrisis) in
38
39 self.rnActor.rnSystem = TheSystem
40 /* PostF01 */
41 and TheSystem.rnctCrisis->select(maxHandlingDelayPassed())
42     = ColctCrisisToAllocateIfPossible
43 and ColctCrisisToAllocateIfPossible->forAll(isAllocatedIfPossible())
44
45 /* PostF02 */
46 and TheSystem.rnctCrisis->select(handlingDelayPassed())
47     = ColctCrisisToHandle
48
49 and ColctCrisisToHandle->msrColSubtract(ColctCrisisToAllocateIfPossible)
50     = ColctCrisisToRemind
51
52 and if (ColctCrisisToRemind->size().geq(1))
53     then (AMessageForCrisisHandlers.value
54         ='There are alerts pending since more than the defined delay. Please REACT !'
55         and TheSystem.rnactAdministrator.
56             rnInterfaceIN^ieMessage(AMessageForCrisisHandlers)
57         and TheSystem.rnactCoordinator
58             ->forAll(rnInterfaceIN^ieMessage(AMessageForCrisisHandlers))
59     )
60 else true
61 endif
62 }
63 postP{
64 let TheSystem: ctState in
65 let TheClock: dtDateAndTime in
66
67 self.rnActor.rnSystem = TheSystem
68 and TheSystem.clock = TheClock
69 and TheSystem@post.vpLastReminder = TheClock
70 }
71
72 prolog{"src/Operations/Environment/OUT/outactActivator-oeSollicitateCrisisHandling.pl"}
73 }
74 }
75 }

```

Listing C.4: Messir Spec. file environment-actActivator-oeSollicitateCrisisHandling.msr.

C.5 File ./src-gen/messir-spec/operations/environment/environment-actAdministrator-oeAddCoordinator.msr

```

1 package icrash.operations.environment.actAdministrator.oeAddCoordinator {
2
3 import lu.uni.lassy.messir.libraries.primitives
4

```

```

5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7 import icrash.environment
8
9 Operation Model {
10
11 operation: actAdministrator.outactAdministrator.oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID ,
12             AdtLogin:dtLogin ,
13             AdtPassword:dtPassword,
14             AdtPhoneNumber:dtPhoneNumber,
15             AetGeographicalLocation:etGeographicalLocation,
16             AetCrisisType:etCrisisType):ptBoolean
17 {
18 prep{
19     let TheSystem: ctState in
20     let TheActor:actAdministrator in
21
22     self.rnActor.rnSystem = TheSystem
23     and self.rnActor = TheActor
24
25 /* PreP01 */
26     and TheSystem.vpStarted = true
27 /* PreP02 */
28     and TheActor.rnctAuthenticated.vpIsLogged = true
29 }
30 preF{
31     let TheSystem: ctState in
32     let TheActor:actAdministrator in
33     let ColctCoordinators:Bag(ctCoordinator) in
34
35     self.rnActor.rnSystem = TheSystem
36     and self.rnActor = TheActor
37 /* PreF01 */
38     and TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
39     = ColctCoordinators
40     and ColctCoordinators->isEmpty() = true
41 }
42 postF{
43     let TheSystem: ctState in
44     let TheactCoordinator:actCoordinator in
45     let ThectCoordinator:ctCoordinator in
46     self.rnActor.rnSystem = TheSystem
47     and self.rnActor = TheActor
48 /* PostF01 */
49     TheactCoordinator.init()
50 /* PostF02 */
51     and ThectCoordinator.init(AdtCoordinatorID,
52             AdtLogin,
53             AdtPassword,
54             AdtPhoneNumber,
55             AetGeographicalLocation,
56             AetCrisisType)
57
58 /* PostF03 */
59     and TheactCoordinator@post.rnctCoordinator = ThectCoordinator
60
61 /* PostF04 */
62     and ThectCoordinator@post.rnactAuthenticated = TheactCoordinator
63
64 /* PostF05 */
65     and TheActor.rnInterfaceIN^ieCoordinatorAdded()
66 }
67 postP{true}
68
69 prolog{"src/Operations/Environment/OUT/outactAdministrator-oeAddCoordinator.pl"}
70 }
71 }
72 }
```

Listing C.5: Messir Spec. file environment-actAdministrator-oeAddCoordinator.msr.

C.6 File ./src-gen/messir-spec/operations/environment/environment-actAdministrator-oeDeleteCoordinator.msr

```

1 package icrash.operations.environment.actAdministrator.oeDeleteCoordinator {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.environment
8
9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11
12 Operation Model {
13
14 operation: actAdministrator.outactAdministrator.oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID
15 ) :ptBoolean
16 prep{
17 let TheSystem: ctState in
18 let TheActor:actAdministrator in
19
20 self.rnActor.rnSystem = TheSystem
21 and self.rnActor = TheActor
22
23 /* PreP01 */
24 and TheSystem.vpStarted = true
25 /* PreP02 */
26 and TheActor.rnctAuthenticated.vpIsLogged = true
27 }
28 pref{
29 let TheSystem: ctState in
30 let TheActor:actAdministrator in
31
32 self.rnActor.rnSystem = TheSystem
33 and self.rnActor = TheActor
34 /* PreF01 */
35 TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
36 = ColctCoordinators
37 and ColctCoordinators->size().eq(1)
38 }
39 postF{
40 let TheSystem: ctState in
41 let TheActor:actAdministrator in
42 let ThectCoordinator:ctCoordinator in
43 self.rnActor.rnSystem = TheSystem
44 and self.rnActor = TheActor
45 /* PostF01 */
46 TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
47 = ThectCoordinator
48 and ThectCoordinator.rnactCoordinator->forAll(msrIsKilled)
49 and ThectCoordinator.msrIsKilled
50
51 /* PostF02 */
52 and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
53
54 /* Post Protocol:*/
55 /* PostP01 */
56 and true
57 }
58 postP{true}
59
60 prolog{"src/Operations/Environment/OUT/outactAdministrator-oeDeleteCoordinator.pl"}
61 }
62 }
63 }

```

Listing C.6: Messir Spec. file environment-actAdministrator-oeDeleteCoordinator.msr.

C.7 File ./src-gen/messir-spec/operations/environment/environment-actAdministrator-oeEditCoordinator.msr

```

1 /*
2 * @author 809279
3 * @date Tue Nov 15 03:56:36 MSK 2016
4 */
5
6 package icrash.operations.environment.actAdministrator.oeEditCoordinator {
7
8 import lu.uni.lassy.messir.libraries.primitives
9 import lu.uni.lassy.messir.libraries.primitives
10 import lu.uni.lassy.messir.libraries.math
11 import lu.uni.lassy.messir.libraries.calendar
12
13 import icrash.environment
14
15 import icrash.concepts.primarytypes.datatypes
16 import icrash.concepts.primarytypes.classes
17
18 Operation Model {
19 operation: actAdministrator.outactAdministrator.oeEditCoordinator(AdtCoordinatorID: dtCoordinatorID
20
21
22     AetGeographicalLocation:etGeographicalLocation,
23     AetCrisisType: etCrisisType):ptBoolean
24 }
25 }
```

Listing C.7: Messir Spec. file environment-actAdministrator-oeEditCoordinator.msr.

C.8 File ./src-gen/messir-spec/operations/environment/environment-actAuthenticated.msr

```

1 package icrash.operations.environment.actAuthenticated{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7 import icrash.concepts.secondarytypes.datatypes
8 import icrash.concepts.secondarytypes.classes
9 import lu.uni.lassy.messir.libraries.string
10 import icrash.environment
11
12 Operation Model {
13
14 operation: actAuthenticated.outactAuthenticated.oeLogin(AdtLogin:dtLogin, AdtPassword:dtPassword) :
15     ptBoolean
16 {
17 prep{
18 let TheSystem: ctState in
19 let TheActor:actAuthenticated in
20 self.rnActor.rnSystem = TheSystem
21 and self.rnActor = TheActor
22 /* PreP01 */
23 and TheSystem.vpStarted = true
24 /* PreP02 */
25 and TheActor.rnctAuthenticated.vpIsLogged = false
26 and TheActor.rnctAuthenticated.vpIsLoggedStep1 = false
27 }
28 preF{
29 /* PreF01 */
30 true
31 }
```

```

32 postF{
33   let TheSystem: ctState in
34   let TheactAuthenticated:actAuthenticated in
35
36   let AptStringMessageForTheactAuthenticated: ptString in
37   let AptStringMessageForTheactAdministrator:ptString in
38
39   self.rnActor.rnSystem = TheSystem
40   and self.rnActor = TheactAuthenticated
41
42   and /* PostF01 */
43     if (TheactAuthenticated.rnctAuthenticated.pwd
44       = AdtPassword
45       and TheactAuthenticated.rnctAuthenticated.login
46       = AdtLogin
47     )
48   then (AptStringMessageForTheactAuthenticated.eq('Login and Password are correct ...')
49     and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
50     and TheSystem.rnactComCompany.rnInterfaceIN^ieSmsSend()
51   )
52   else (AptStringMessageForTheactAuthenticated
53     .eq('Wrong identification information ! Please try again ...')
54     and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
55     and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
56     and TheSystem.rnactAdministrator
57     .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
58   )
59   endif
60 }
61 postP{
62   let TheSystem: ctState in
63   let TheactAuthenticated:actAuthenticated in
64
65   self.rnActor.rnSystem = TheSystem
66   and self.rnActor = TheactAuthenticated
67   if (TheactAuthenticated.rnctAuthenticated.pwd
68     = AdtPassword
69     and TheactAuthenticated.rnctAuthenticated.login
70     = AdtLogin
71   )
72   then (TheactAuthenticated.rnctAuthenticated@post.vpIsLoggedStep1 = true)
73   else false
74   endif
75 }
76 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogin.pl"}
77 }
78 /*-----*/
79 operation: actAuthenticated.outactAuthenticated.oeSMS(smsCode:dtString):ptBoolean{
80 prep{
81   let TheSystem: ctState in
82   let TheActor:actAuthenticated in
83   self.rnActor.rnSystem = TheSystem
84   and self.rnActor = TheActor
85   /* PreP01 */
86   and TheSystem.vpStarted = true
87   /* PreP02 */
88   and TheActor.rnctAuthenticated.vpIsLogged = false
89   and TheActor.rnctAuthencitated.vpIsloggedStep1 = true
90 }
91 preF{
92   true
93 }
94 postF{
95   let TheSystem: ctState in
96   let TheactAuthenticated:actAuthenticated in
97
98   let AptStringMessageForTheactAuthenticated: ptString in
99   let AptStringMessageForTheactAdministrator:ptString in
100
101  self.rnActor.rnSystem = TheSystem

```

```

102    and self.rnActor = TheactAuthenticated
103
104    and /* PostF01 */
105      if (TheactAuthenticated.rnctAuthenticated.smscode
106        = smsCode)
107      then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
108        and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
109        )
110      else false
111    endif
112 }
113 postP{
114   let TheSystem: ctState in
115   let TheactAuthenticated:actAuthenticated in
116
117   self.rnActor.rnSystem = TheSystem
118   and self.rnActor = TheactAuthenticated
119 /* PostP01 */
120   if (TheactAuthenticated.rnctAuthenticated.smscode = smsCode)
121   then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
122   else false
123   endif
124 }
125 }
126 /*-----*/
127 operation: actAuthenticated.outactAuthenticated.oeLogout ():ptBoolean{
128
129 preP{
130   let TheSystem: ctState in
131   let TheActor:actAdministrator in
132   self.rnActor.rnSystem = TheSystem
133   and self.rnActor = TheActor
134
135 /* PreP01 */
136   and TheSystem.vpStarted = true
137 /* PreP02 */
138   and TheActor.rnctAuthenticated.vpIsLogged = true
139 }
140 preF{
141 /* PreF01 */
142 true
143 }
144 postF{
145   let TheSystem: ctState in
146   let TheactAuthenticated:actAuthenticated in
147   let AptStringMessageForTheactAuthenticated: ptString in
148
149   self.rnActor.rnSystem = TheSystem
150   and self.rnActor = TheactAuthenticated
151
152 /* PostF01 */
153 AptStringMessageForTheactAuthenticated.eq('You are logged out ! Good Bye ...')
154 and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
155 }
156 postP{
157   let TheSystem: ctState in
158   let TheactAuthenticated:actAuthenticated in
159
160   self.rnActor.rnSystem = TheSystem
161   and self.rnActor = TheactAuthenticated.assSet
162 /* PostP01 */
163 TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = false
164 }
165 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogout.pl"}
166 }
167 }
168 }
```

Listing C.8: Messir Spec. file environment-actAuthenticated.msr.

C.9 File ./src-gen/messir-spec/operations/environment/environment-actComCompany.msr

```

1 // Do not add/remove lines because code is inserted in slides
2
3 package icrash.operations.environment.actComCompany{
4
5 import lu.uni.lassy.messir.libraries.primitives
6 import lu.uni.lassy.messir.libraries.calendar
7 import lu.uni.lassy.messir.libraries.math
8
9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11 import icrash.concepts.secondarytypes.datatypes
12
13 import icrash.environment
14
15 Operation Model {
16
17 operation: actComCompany.outactComCompany.oeAlert(
18   AetKind:etHumanKind,
19   AdtMyDate:dtDate,
20   AdtTime:dtTime,
21   AdtPhoneNumber:dtPhoneNumber,
22   AdtGPSLocation:dtGPSLocation,
23   AdtComment:dtComment,
24   AetCrisisType:etCrisisType
25 ) :ptBoolean{
26
27 preP{
28   let TheSystem: ctState in
29   self.rnActor.rnSystem = TheSystem
30
31 /* PreP01 */
32 and TheSystem.vpStarted = true
33 }
34 preF{
35   let TheSystem: ctState in
36   self.rnActor.rnSystem = TheSystem
37
38 /* PreF01 */
39 and (TheSystem.clock.date.gt(AdtDate)
40       or (TheSystem.clock.date.eq(AdtDate)
41             and TheSystem.clock.time.gt(AdtTime)
42           )
43         )
44 }
45 postF{
46   let TheSystem: ctState in
47
48   let ActHuman:ctHuman in
49   let TheactComCompany:actComCompany in
50   let ActAlert:ctAlert in
51   let AAlertInstant:dtDateAndTime in
52   let AetAlertStatus:etAlertStatus in
53   let ActAlertNearBy:ctAlert in
54   let ActCrisis:ctCrisis in
55   let AdtCrisisID:dtCrisisID in
56   let AetCrisisType:etCrisisType in
57   let AetCrisisStatus:etCrisisStatus in
58   let ACrisisInstant:dtDateAndTime in
59   let ACrisisdtComment:dtComment in
60   let AptStringMessage:ptString in
61   let AdtSMS:dtSMS in
62   let AdtAlertID:dtAlertID in
63
64   self.rnActor.rnSystem = TheSystem
65   and self.rnActor = TheactComCompany
66 /* PostF01 */

```

```

67 TheSystem.nextValueForAlertID=PrenextValueForAlertID
68 and PrenextValueForAlertID.add(1) = PostnextValueForAlertID
69 and TheSystem@post.nextValueForAlertID = PostnextValueForAlertID
70
71 /* PostF02 */
72 and AAlertInstant.date=AdtDate
73 and AAlertInstant.time=AdtTime
74
75 and AetAlertStatus=pending
76
77 and TheSystem.nextValueForAlertID.todtString().eq(AdtAlertID)
78
79 and ActAlert.init(AdtAlertID,
80     AetAlertStatus,
81     AdtGPSLocation,
82     AAlertInstant,
83     AdtComment)
84
85 /* PostF03 */
86 and TheSystem.rnctAlert.select(location.isNearTo(AdtGPSLocation)) = ColctAlertsNearBy
87 and if (ColctAlertsNearBy->size()!=0)
88   then (TheSystem.nextValueForCrisisID = PrenextValueForCrisisID
89     and PrenextValueForCrisisID.add(1) = PostnextValueForCrisisID
90     and TheSystem@post.nextValueForCrisisID = PostnextValueForCrisisID
91     and TheSystem.nextValueForCrisisID.todtString().eq(AdtCrisisID)
92     and AdtCrisisType = small
93     and AetCrisisStatus = pending
94     and ACrisisInstant= AAlertInstant
95     and ACrisisdtComment = 'no reporting yet defined'
96     and ActCrisis.init( AdtCrisisID,
97         AdtCrisisType,
98         AetCrisisStatus,
99         AdtGPSLocation,
100        ACrisisInstant,
101        ACrisisdtComment)
102   )
103 else (ColctAlertsNearBy.rnTheCrisis->msrAny(true) = ActCrisis)
104 endif
105
106 /* PostF04 */
107 and ActAlert@post.rnTheCrisis = ActCrisis
108
109 /* PostF05 */
110 and TheSystem.rnctHuman->select(id.eq(AdtPhoneNumber)) = HumanCol1
111
112 and HumanCol1->select(kind.etEq(AetHumanKind)) = HumanCol2
113 and if (HumanCol2->msrIsEmpty)
114   then (ActHuman.init(AdtPhoneNumber,AetHumanKind)
115     and ActHuman@post.rnactComCompany = TheactComCompany
116   )
117   else (HumanCol2->any(true) = ActHuman)
118 endif
119
120 and ActHuman.rnSignaled->msrIncluding(ActAlert) = ColAlerts
121
122 and ActHuman@post.rnSignaled = ColAlerts
123
124 /* PostF06 */
125 AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
126 and TheactComCompany.rnInterfaceIN^ieSmsSend(AdtPhoneNumber,AdtSMS)
127 }
128 /* Post Protocol:*/
129 /* PostP01 */
130 postP{true}
131
132 prolog{"src/Operations/Environment/OUT/outactComCompany-oeAlert.pl"}
133 }
134 }
```

135 }

Listing C.9: Messir Spec. file environment-actComCompany.msr.

C.10 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeCloseCrisis.msr

```

1 package icrash.operations.environment.actCoordinator.oeCloseCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeCloseCrisis(AdtCrisisID:dtCrisisID):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeCloseCrisis.pl"}
14 }
15 }
16 }
```

Listing C.10: Messir Spec. file environment-actCoordinator-oeCloseCrisis.msr.

C.11 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeGetAlertsSet.msr

```

1 package icrash.operations.environment.actCoordinator.oeGetAlertsSet {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.environment
10
11 Operation Model {
12
13 operation: actCoordinator.outactCoordinator.oeGetAlertsSet(AetAlertStatus:etAlertStatus):ptBoolean{
14 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeGetAlertsSet.pl"}
15 }
16 }
17 }
```

Listing C.11: Messir Spec. file environment-actCoordinator-oeGetAlertsSet.msr.

C.12 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeGetCrisisSet.msr

```

1 package icrash.operations.environment.actCoordinator.oeGetCrisisSet {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11 }
```

```

12 operation: actCoordinator.outactCoordinator.oeGetCrisisSet(AetCrisisStatus:etCrisisStatus):ptBoolean
    {
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeGetCrisisSet.pl"}
14 }
15 }
16 }
```

Listing C.12: Messir Spec. file environment-actCoordinator-oeGetCrisisSet.msr.

C.13 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeInvalidateAlert.msr

```

1 package icrash.operations.environment.actCoordinator.oeInvalidateAlert {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeInvalidateAlert(AdtAlertID:dtAlertID):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeInvalidateAlert.pl"}
14 }
15 }
16 }
```

Listing C.13: Messir Spec. file environment-actCoordinator-oeInvalidateAlert.msr.

C.14 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeReportOnCrisis.msr

```

1 package icrash.operations.environment.actCoordinator.oeReportOnCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeReportOnCrisis(AdtCrisisID:dtCrisisID, AdtComment:
    dtComment):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeReportOnCrisis.pl"}
14 }
15
16 }
17 }
```

Listing C.14: Messir Spec. file environment-actCoordinator-oeReportOnCrisis.msr.

C.15 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisHandler.msr

```

1 package icrash.operations.environment.actCoordinator.oeSetCrisisHandler {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
```

```

7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.secondarytypes.datatypes
11 import icrash.environment
12
13 Operation Model {
14
15 operation: actCoordinator.outactCoordinator.oeSetCrisisHandler(AdtCrisisID:dtCrisisID):ptBoolean{
16 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisHandler.pl"}
17 }
18
19 }
20 }
```

Listing C.15: Messir Spec. file environment-actCoordinator-oeSetCrisisHandler.msr.

C.16 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisStatus.msr

```

1 package icrash.operations.environment.actCoordinator.oeSetCrisisStatus {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeSetCrisisStatus(AdtCrisisID:dtCrisisID,
13   AetCrisisStatus:etCrisisStatus):ptBoolean{
14 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisStatus.pl"}
15 }
16
17 }
```

Listing C.16: Messir Spec. file environment-actCoordinator-oeSetCrisisStatus.msr.

C.17 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisType.msr

```

1 package icrash.operations.environment.actCoordinator.oeSetCrisisType {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeSetCrisisType(AdtCrisisID:dtCrisisID, AetCrisisType:
13   etCrisisType):ptBoolean{
14 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisType.pl"}
15 }
16
17 }
```

Listing C.17: Messir Spec. file environment-actCoordinator-oeSetCrisisType.msr.

C.18 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeValidateAlert.msr

```

1 package icrash.operations.environment.actCoordinator.oeValidateAlert {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeValidateAlert(AdtAlertID:dtAlertID):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeValidateAlert.pl"}
14 }
15
16 }
17 }
```

Listing C.18: Messir Spec. file environment-actCoordinator-oeValidateAlert.msr.

C.19 File ./src-gen/messir-spec/operations/environment/environment-actMsrCreator-init.msr

```

1 package icrash.operations.icrash.environment.actMsrCreator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.environment
5
6 Operation Model {
7
8 operation: actMsrCreator.init():ptBoolean{
9 // generic operation provided by the simulator
10 }
11 }
```

Listing C.19: Messir Spec. file environment-actMsrCreator-init.msr.

C.20 File ./src-gen/messir-spec/operations/environment/environment-actMsrCreator-oeCreateSystemAndEnvironment.msr

```

1 package icrash.operations.environment.actMsrCreator.oeCreateSystemAndEnvironment{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.concepts.primarytypes.classes
9 import icrash.concepts.secondarytypes.datatypes
10 import icrash.concepts.secondarytypes.classes
11 import icrash.environment
12
13 Operation Model {
14
15 operation: actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger):
16 ptBoolean
16 {preP{true}}
17 preF{true}
18 postF{
19 let TheSystem: ctState in
20 let AactMsrCreator: actMsrCreator in
21 let AactAdministrator: actAdministrator in
```

```

22 let AnextValueForAlertID: dtInteger in
23 let AnextValueForCrisisID: dtInteger in
24 let Aclock: dtDateAndTime in
25 let AcrisisReminderPeriod: dtSecond in
26 let AmaxCrisisReminderPeriod: dtSecond in
27 let AvpStarted: ptBoolean in
28
29 /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
30 AnextValueForAlertID.value.eq(1)
31 and AnextValueForCrisisID.value.eq(1)
32 and Aclock.date.year.value = 1970
33 and Aclock.date.month.value = 01
34 and Aclock.date.day.value = 01
35 and Aclock.time.hour.value = 00
36 and Aclock.time.minute.value = 00
37 and Aclock.time.second.value = 00
38
39 and AcrisisReminderPeriod.value.eq(300)
40 and AmaxCrisisReminderPeriod.value.eq(1200)
41 and AvpStarted = true
42 and TheSystem.init(AnextValueForAlertID,
43     AnextValueForCrisisID,
44     Aclock,
45     AcrisisReminderPeriod,
46     AmaxCrisisReminderPeriod,
47     Aclock,
48     AvpStarted
49 )
50 /* PostF02*/
51 and AactMsrCreator.init()
52 /* PostF03 */
53 and let AactComCompanyCol: Bag(actComCompany) in
54 AactComCompanyCol->size() = AqtyComCompanies
55 AactComCompanyCol-> forAll(init())
56 /* PostF04*/
57 and AactAdministrator.init()
58 /* PostF05*/
59 and let AactActivator:actActivator in
60 AactActivator.init()
61 /* PostF06 */
62 and let ActAdministrator:ctAdministrator in
63     let AdtLogin:dtLogin in
64         let AdtPassword:dtPassword in
65             AdtLogin.value.eq('icrashadmin')
66             and AdtPassword.value.eq('7WXC1359')
67             and ActAdministrator.init(AdtLogin,AdtPassword)
68 /* PostF07*/
69 and ActAdministrator@post.rnactAuthenticated = AactAdministrator
70 postP{true}
71
72 prolog{ "src/Operations/Environment/OUT/outactMsrCreator-oeCreateSystemAndEnvironment.pl"}
73
74 }
75 }
76
77 }

```

Listing C.20: Messir Spec. file environment-actMsrCreator-oeCreateSystemAndEnvironment.msr.

C.21 File ./src-gen/messir-spec/environment/environment.msr

```

1 package icrash.environment{
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.concepts.primarytypes.classes
5 import icrash.concepts.secondarytypes.datatypes
6 import lu.uni.lassy.messir.libraries.primitives
7 import lu.uni.lassy.messir.libraries.math
8 import lu.uni.lassy.messir.libraries.calendar

```

```

9 import lu.uni.lassy.messir.libraries.string
10
11 Environment Model {
12
13   actor actMsrCreator role rnactMsrCreator cardinality [1..1] {
14
15     operation init():ptBoolean
16
17     input interface inactMsrCreator {
18     }
19     output interface outactMsrCreator {
20       operation oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger ):ptBoolean
21     }
22   }
23
24   actor actAdministrator
25     role rnactAdministrator
26     cardinality [1..1]
27     extends actAuthenticated {
28
29     operation init():ptBoolean
30
31     output interface outactAdministrator{
32
33       operation oeAddCoordinator(
34         AdtCoordinatorID:dtCoordinatorID ,
35         AdtLogin:dtLogin ,
36         AdtPassword:dtPassword,
37         AdtPhoneNumber:dtPhoneNumber,
38         AetGeographicalLocation:etGeographicalLocation,
39         AetCrisisType:etCrisisType):ptBoolean
40       operation oeDeleteCoordinator(
41         AdtCoordinatorID:dtCoordinatorID ):ptBoolean
42       operation oeEditCoordinator(AdtCoordinatorID: dtCoordinatorID,
43         AetGeographicalLocation:etGeographicalLocation,
44         AetCrisisType: etCrisisType):ptBoolean
45     }
46
47     input interface inactAdministrator{
48
49       operation ieCoordinatorAdded():ptBoolean
50       operation ieCoordinatorDeleted():ptBoolean
51       operation ieCoordinatorEdited(): ptBoolean
52     }
53   }
54
55   actor actCoordinator
56     role rnactCoordinator
57     cardinality [0..*]
58     extends actAuthenticated{
59
60     operation init():ptBoolean
61
62     output interface outactCoordinator{
63       operation oeInvalidateAlert(AdtAlertID:dtAlertID ):ptBoolean
64       operation oeCloseCrisis(AdtCrisisID:dtCrisisID ):ptBoolean
65       operation oeGetAlertsSet(AetAlertStatus:etAlertStatus ):ptBoolean
66       operation oeGetCrisisSet(AetCrisisStatus:etCrisisStatus ):ptBoolean
67       operation oeSetCrisisHandler(AdtCrisisID:dtCrisisID ):ptBoolean
68       operation oeReportOnCrisis(
69         AdtCrisisID:dtCrisisID ,
70         AdtComment:dtComment
71         ):ptBoolean
72       operation oeSetCrisisStatus(
73         AdtCrisisID:dtCrisisID ,
74         AetCrisisStatus:etCrisisStatus
75         ):ptBoolean
76       operation oeSetCrisisType(
77         AdtCrisisID:dtCrisisID ,
78         AetCrisisType:etCrisisType

```

```

79           ):ptBoolean
80     operation oeValidateAlert(AdtAlertID:dtAlertID ):ptBoolean
81   }
82
83   input interface inactCoordinator{
84     operation ieSendAnAlert(ActAlert:ctAlert ):ptBoolean
85     operation ieSendACrisis(ActCrisis:ctCrisis ):ptBoolean
86   }
87 }
88
89 actor actComCompany role rnactComCompany cardinality [0..*]{
90
91   operation init():ptBoolean
92
93   output interface outactComCompany{
94     operation oeAlert(
95       AetHumanKind:etHumanKind ,
96       AdtDate:dtDate ,
97       AdtTime:dtTime ,
98       AdtPhoneNumber:dtPhoneNumber ,
99       AdtGPSLocation:dtGPSLocation ,
100      AdtComment:dtComment,
101      AetCrisisType:etCrisisType
102    ):ptBoolean
103  }
104 //oeSendSms
105   input interface inactComCompany{
106     operation ieSMSSend(AdtPhoneNumber:dtPhoneNumber ,
107       AdtSMS:dtSMS
108     ):ptBoolean
109   }
110 }
111
112 actor actAuthenticated role rnactAuthenticated cardinality [0..*]{
113
114   operation init():ptBoolean
115
116   output interface outactAuthenticated{
117     operation oeLogin(AdtLogin:dtLogin , AdtPassword:dtPassword ):ptBoolean
118     operation oeSMS (AdtString: dtString): ptBoolean
119     operation oeLogout():ptBoolean
120   }
121
122   input interface inactAuthenticated{
123     operation ieMessage(AMessage:ptString):ptBoolean
124   }
125 }
126
127 actor actActivator[proactive] role rnactActivator cardinality [1..1]{
128
129   operation init():ptBoolean
130
131   output interface outactActivator{
132     proactive operation oeSollicitateCrisisHandling():ptBoolean
133     proactive operation oeSetClock(AcurrentClock:dtDateAndTime ):ptBoolean
134   }
135
136   input interface inactActivator{
137   }
138 }
139 }
140 }

```

Listing C.21: Messir Spec. file environment.msr.

C.22 File [./src-gen/messir-spec/concepts/primarytypes-associations.msr](#)

```
1 package icrash.concepts.primarytypes.associations {
```

```

2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.concepts.primarytypes.classes
5 import icrash.environment
6 import lu.uni.lassy.messir.libraries.primitives
7
8 Concept Model {
9
10 Primary Types{
11
12 // Internal
13
14 association assctAlertctCrisis
15 ctAlert(rnAlerts) [1..*]
16 ctCrisis (rnTheCrisis) [1..1]
17
18 association assctAlertctHuman
19 ctAlert(rnSignaled) [1..*]
20 ctHuman (rnSignaler) [1..1]
21
22 association assctCrisisctCoordinator
23 ctCrisis(rnHandled) [0..*]
24 ctCoordinator(rnHandler) [0..1]
25
26 // With Actors
27
28 association assctHumanactComCompany
29 ctHuman(rnctHuman) [0..*]
30 actComCompany(rnactComCompany) [1..1]
31
32 association assctCoordinatoractCoordinator
33 ctCoordinator(rnctCoordinator) [1..1]
34 actCoordinator(rnactCoordinator) [1..1]
35
36 association assctAuthenticatedactAuthenticated
37 ctAuthenticated(rnctAuthenticated) [1..1]
38 actAuthenticated(rnactAuthenticated) [1..1]
39
40 }
41 }
42 }
```

Listing C.22: Messir Spec. file primarytypes-associations.msr.

C.23 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAdministrator.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctAdministrator
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.classes.ctAdministrator.init(
11   Alogin:dtLogin ,
12   Apwd:dtPassword,
13   AphoneNumber:dtPhoneNumber
14   ):ptBoolean{
15 postF{
16 if
17 (
18 let Self:ctAdministrator in
19 /* Post F01 */
20 Self.login(Alogin)
21 and Self.pwd = Apwd
```

```

22 and Self.phoneNumber = AphoneNumber
23 and Self.vpIsLogged = false
24
25 /* Post F02 */
26 and (Self.oclIsNew and self = Self)
27 )
28 then (result = true)
29 else (result = false)
30 endif
31 }
32 prolog{ "src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAdministrator-init.pl"
33 }
34 }
35 }

```

Listing C.23: Messir Spec. file primarytypes-classes-ctAdministrator.msr.

C.24 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAlert.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctAlert{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.calendar
5
6 import icrash.concepts.primarytypes.datatypes
7 import icrash.concepts.primarytypes.classes
8
9 import icrash.environment
10
11 Operation Model {
12
13 operation: icrash.concepts.primarytypes.classes.ctAlert.init(Aid:dtAlertID ,
14 Astatus:etAlertStatus ,
15 Alocation:dtGPSLocation ,
16 Ainstant:dtDateAndTime ,
17 Acomment:dtComment ,
18 AcrisisType:etCrisisType
19 ):ptBoolean{
20 postF{
21 if
22 (
23 /* Post F01 */
24 let Self:ctAlert in
25 Self.id = Aid
26 and Self.status = Astatus
27 and Self.location = Alocation
28 and Self.instant = Ainstant
29 and Self.comment = Acomment
30 and Self.crisisType = AcrisisType
31 /* Post F02 */
32 and (Self.oclIsNew and self = Self)
33 )
34 then (result = true)
35 else (result = false)
36 endif
37 }
38 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAlert-init.pl"
39 }
40
41 operation: icrash.concepts.primarytypes.classes.ctAlert.isSentToCoordinator(AactCoordinator:
42 actCoordinator ):ptBoolean
43 {
44 postF{
45 if
46 (
47 /* Post F01 */
48 AactCoordinator.rnInterfaceIN.ieSendAnAlert(self)

```

```

48 )
49 then (result = true)
50 else (result = false)
51 endif
52 }
53 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAlert-isSentToCoordinator.
      pl"}
54
55 }
56 }
57 }

```

Listing C.24: Messir Spec. file primarytypes-classes-ctAlert.msr.

C.25 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAuthenticated.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctAuthenticated {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.concepts.primarytypes.classes
6
7 Operation Model {
8
9 operation: icrash.concepts.primarytypes.classes.ctAuthenticated.init(Alogin:dtLogin, Apwd:dtPassword
   , AphoneNumber:dtPhoneNumber):ptBoolean{
10 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAuthenticated-init.pl"}
11 }
12 }
13
14 }

```

Listing C.25: Messir Spec. file primarytypes-classes-ctAuthenticated.msr.

C.26 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctCoordinator.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctCoordinator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.concepts.primarytypes.classes
6
7 Operation Model {
8
9 operation: icrash.concepts.primarytypes.classes.ctCoordinator.init(Aid:dtCoordinatorID ,
10           Alogin:dtLogin ,
11           Apwd:dtPassword,
12           AphoneNumber:dtPhoneNumber,
13           AgeographicalLocation:etGeographicalLocation,
14           AcrisisType:etCrisisType):ptBoolean
15 {
16 postF{
17 if
18 (
19 /* Post F01 */
20 let Self:ctCoordinator in
21 Self.id = Aid
22 and Self.login = Alogin
23 and Self.pwd = Apwd
24 and Self.phoneNumber = AphoneNumber
25 and Self.geographicalLocation = AgeographicalLocation
26 and Self.crisisType = AcrisisType
27 and Self.vpIsLogged = false
28 /* Post F02 */

```

```

29 and (Self.oclIsNew and self = Self)
30 )
31 then (result = true)
32 else (result = false)
33 endif}
34 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCoordinator-init.pl"}
35 }
36 }
37 }

```

Listing C.26: Messir Spec. file primarytypes-classes-ctCoordinator.msr.

C.27 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctCrisis.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.concepts.primarytypes.classes
9 import icrash.concepts.secondarytypes.datatypes
10 import icrash.concepts.secondarytypes.classes
11 import lu.uni.lassy.messir.libraries.primitives
12
13 import icrash.environment
14
15 Operation Model {
16 /**
17 operation: icrash.concepts.primarytypes.classes.ctCrisis.init(
18     Aid:dtCrisisID,
19     Atype:etCrisisType,
20     Astatus:etCrisisStatus,
21     Alocation:dtGPSLocation,
22     Ainstant:dtDateAndTime,
23     Acomment:dtComment
24     ):ptBoolean{
25 postF{
26 if
27 (
28 /* Post F01 */
29 let Self:ctCrisis in
30 Self.id = Aid
31 and Self.type = Atype
32 and Self.status = Astatus
33 and Self.location = Alocation
34 and Self.instant = Ainstant
35 and Self.comment = Acomment
36 /* Post F02 */
37 and (Self.oclIsNew and self = Self)
38 )
39 then (result = true)
40 else (result = false)
41 endif}
42 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-init.pl"}}
43 /**
44 operation: icrash.concepts.primarytypes.classes.ctCrisis.handlingDelayPassed():ptBoolean
45 {
46 postF{
47 let TheSystem:ctState in
48 let CurrentClockSecondsQty:dtInteger in
49 let vpLastReminderSecondsQty:dtInteger in
50 let CrisisReminderPeriod:dtSecond in
51 if
52 ( /* Post F01 */
53 self.rnSystem = TheSystem

```

```

54 and self.status = pending
55 and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
56 and TheSystem.vpLastReminder.toSecondsQty() = vpLastReminderSecondsQty
57 and TheSystem.crisisReminderPeriod = CrisisReminderPeriod
58 and CurrentClockSecondsQty.sub(vpLastReminderSecondsQty).gt(CrisisReminderPeriod) = true
59 )
60 then (result = true)
61 else (result = false)
62 endif
63 }
64 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-handlingDelayPassed
       .pl"})
65 //-----
66 operation: icrash.concepts.primarytypes.classes.ctCrisis.maxHandlingDelayPassed():ptBoolean
67 {
68 postF{
69 let TheSystem:ctState in
70 let CurrentClockSecondsQty:dtInteger in
71 let CrisisInstantSecondsQty:dtInteger in
72 let MaxCrisisReminderPeriod:dtSecond in
73 if
74 ( /* Post F01 */
75 self.rnSystem = TheSystem
76 and self.status = pending
77 and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
78 and Self.instant.toSecondsQty() = CrisisInstantSecondsQty
79 and TheSystem.maxCrisisReminderPeriod = MaxCrisisReminderPeriod
80 and CurrentClockSecondsQty.sub(CrisisInstantSecondsQty)
81           .gt (MaxCrisisReminderPeriod)
82 )
83 then (result = true)
84 else (result = false)
85 endif
86 }
87 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-
       maxHandlingDelayPassed.pl"}
88 //-----
89 operation: icrash.concepts.primarytypes.classes.ctCrisis.isSentToCoordinator(AactCoordinator:
       actCoordinator):ptBoolean
90 {
91 postF{
92 if
93 (
94 /* Post F01 */
95 AactCoordinator.rnInterfaceIN.ieSendACrisis(self)
96 )
97 then (result = true)
98 else (result = false)
99 endif}
100 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-isSentToCoordinator
       .pl" }
101 //-----
102 operation: icrash.concepts.primarytypes.classes.ctCrisis.isAllocatedIfPossible():ptBoolean
103 {
104 postF{
105 if (
106 /* Post F01 */
107 self.maxHandlingDelayPassed()
108 and
109 if (TheSystem.rnactCoordinator->msrIsEmpty = false)
110 then (
111   /* Post F02 */
112   TheSystem.rnactCoordinator->msrAny(true) = TheCoordinatorActor
113   and TheCoordinatorActor.rnctCoordinator = TheCoordinator
114   and self@post.rnHandler = TheCoordinator
115   and self@post.status = handled
116   and self.id.value = TheCrisisIDptString
117   and 'You are now considered as handling the crisis having ID: '
118     .ptStringConcat(TheCrisisIDptString) = TheMessage
119   and TheCoordinatorActor.rnInterfaceIN^ieMessage(TheMessage)

```

```

120  )
121 else ( /* Post F03 */
122     TheSystem.rnactAdministrator
123     ->forall(rnInterfaceIN.ieMessage('Please add new coordinators to handle pending crisis !'))
124 )
125 endif
126 )
127 then (result = true)
128 else (result = false)
129 endif
130 }
131 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-
    isAllocatedIfPossible.pl"}
132 }
133 }
134 }
```

Listing C.27: Messir Spec. file primarytypes-classes-ctCrisis.msr.

C.28 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctHuman.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctHuman.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5
6 import icrash.concepts.primarytypes.classes
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.classes.ctHuman.init(Aid:dtPhoneNumber, Akind:etHumanKind):
    ptBoolean
11 {
12 postF{
13 if
14 (
15 /* Post F01 */
16 let Self:ctHuman in
17
18 Self.id = Aid
19 and Self.kind = Akind
20
21 /* Post F02 */
22 and (Self.oclIsNew and self = Self)
23 )
24 then (result = true)
25 else (result = false)
26 endif
27 }
28 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctHuman-init.pl"}
29 }
30 operation: icrash.concepts.primarytypes.classes.ctHuman.isAcknowledged():ptBoolean{
31 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctHuman-isAcknowledged.pl"}
32 }
33 }
34 }
```

Listing C.28: Messir Spec. file primarytypes-classes-ctHuman.msr.

C.29 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctState.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctState{
2
3 import lu.uni.lassy.messir.libraries.primitives
```

```

4 import lu.uni.lassy.messir.libraries.calendar
5 import lu.uni.lassy.messir.libraries.math
6
7 import icrash.concepts.primarytypes.classes
8
9 Operation Model {
10
11 operation: icrash.concepts.primarytypes.classes.ctState.init(
12   AnextValueForAlertID: dtInteger,
13   AnextValueForCrisisID: dtInteger ,
14   dtAclock:dtDateAndTime,
15   AcrisisReminderPeriod: dtSecond,
16   AmaxCrisisReminderPeriod: dtSecond ,
17   AvpLastReminder: dtDateAndTime ,
18   AvpStarted:ptBoolean ):ptBoolean{
19 postF{
20 if
21 (
22 /* Post F01 */
23 let Self:ctState in
24
25 Self.nextValueForAlertID = AnextValueForAlertID
26 and Self.nextValueForCrisisID = AnextValueForCrisisID
27 and Self.clock = Aclock
28 and Self.crisisReminderPeriod = AcrisisReminderPeriod
29 and Self.maxCrisisReminderPeriod = AmaxCrisisReminderPeriod
30 and Self.vpLastReminder = AvpLastReminder
31 and Self.vpStarted = AvpStarted
32
33 and (Self.oclIsNew and self = Self)
34 )
35 then (result = true)
36 else (result = false)
37 endif
38 }
39 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctState-init.pl" }
40 }
41 }
42 }

```

Listing C.29: Messir Spec. file primarytypes-classes-ctState.msr.

C.30 File ./src-gen/messir-spec/concepts/primarytypes-classes.msr

```

1 package icrash.concepts.primarytypes.classes {
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.environment
5 import lu.uni.lassy.messir.libraries.primitives
6 import lu.uni.lassy.messir.libraries.math
7 import lu.uni.lassy.messir.libraries.calendar
8
9 Concept Model {
10
11 Primary Types{
12
13 state class ctState {
14   attribute nextValueForAlertID:dtInteger
15   attribute nextValueForCrisisID:dtInteger
16   attribute clock:dtDateAndTime
17   attribute crisisReminderPeriod:dtSecond
18   attribute maxCrisisReminderPeriod:dtSecond
19   attribute vpLastReminder:dtDateAndTime
20   attribute vpStarted:ptBoolean
21
22 operation init( AnextValueForAlertID:dtInteger,
23                 AnextValueForCrisisID:dtInteger,
24                 Aclock:dtDateAndTime,
25                 AcrisisReminderPeriod:dtSecond ,

```

```

26         AmaxCrisisReminderPeriod:dtSecond ,
27         AvpLastReminder:dtDateAndTime ,
28         AvpStarted:ptBoolean
29     }
30
31 class ctAlert role rnctAlert cardinality [0..*]{
32     attribute id:dtAlertID
33     attribute status: etAlertStatus
34     attribute location:dtGPSLocation
35     attribute instant:dtDateAndTime
36     attribute comment:dtComment
37     attribute crisisType:etCrisisType
38
39     operation init(    Aid:dtAlertID ,
40                     Astatus:etAlertStatus ,
41                     Alocation:dtGPSLocation ,
42                     Ainstant:dtDateAndTime ,
43                     Acomment:dtComment,
44                     AcrisisType:etCrisisType):ptBoolean
45     operation isSentToCoordinator(AactCoordinator:actCoordinator ):ptBoolean
46
47 }
48
49 class ctCrisis role rnctCrisis cardinality [0..*]{
50     attribute id:dtCrisisID
51     attribute type:etCrisisType
52     attribute status: etCrisisStatus
53     attribute location:dtGPSLocation
54     attribute instant:dtDateAndTime
55     attribute comment:dtComment
56
57     operation init(
58                     Aid:dtCrisisID ,
59                     Atype:etCrisisType ,
60                     Astatus:etCrisisStatus ,
61                     Alocation:dtGPSLocation ,
62                     Ainstant:dtDateAndTime ,
63                     Acomment:dtComment ):ptBoolean
64
65     operation handlingDelayPassed():ptBoolean
66         operation maxHandlingDelayPassed():ptBoolean
67     operation isSentToCoordinator(AactCoordinator:actCoordinator ):ptBoolean
68     operation isAllocatedIfPossible():ptBoolean
69 }
70
71 class ctHuman role rnctHuman cardinality [0..*]{
72     attribute id:dtPhoneNumber
73     attribute kind:etHumanKind
74
75     operation init(
76                     Aid:dtPhoneNumber ,
77                     Akind:etHumanKind ):ptBoolean
78     operation isAcknowledged():ptBoolean
79 }
80
81 class ctAuthenticated
82     role rnctAuthenticated
83     cardinality [0..*]{
84
85     attribute login:dtLogin
86     attribute pwd: dtPassword
87     attribute phoneNumber:dtPhoneNumber
88     attribute vpIsLogged:ptBoolean
89     attribute vpIsLoggedStep1:ptBoolean
90
91     operation init(
92                     Alogin:dtLogin ,
93                     Apwd:dtPassword,
94                     AphoneNumber:dtPhoneNumber ):ptBoolean
95 }

```

```

96
97   class ctCoordinator
98     role rnctCoordinator
99     cardinality [0..*]
100    extends ctAuthenticated{
101
102    attribute id:dtCoordinatorID
103    attribute geographicalLocation:etGeographicalLocation
104    attribute crisisType:etCrisisType
105
106    operation init(
107      Aid:dtCoordinatorID ,
108      Alogin:dtLogin ,
109      Apwd:dtPassword,
110      AphoneNumber:dtPhoneNumber,
111      AgeographicalLocation:etGeographicalLocation,
112      AcrisisType:etCrisisType) :ptBoolean
113  }
114
115  class ctAdministrator
116    role rnctAdministrator
117    cardinality [1..1]
118    extends ctAuthenticated{
119
120    operation init(
121      Alogin:dtLogin ,
122      Apwd:dtPassword,
123      AphoneNumber:dtPhoneNumber ) :ptBoolean
124  }
125 }
126 }
127 }
```

Listing C.30: Messir Spec. file primarytypes-classes.msr.

C.31 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtAlertID.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtAlertID{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtAlertID.is():ptBoolean{
8
9     postF{
10       let TheResult: ptBoolean in
11       ( if
12         ( AdtValue.value.length().gt(0)
13           and AdtValue.value.length().leq(20)
14         )
15         then (TheResult = true)
16         else (TheResult = false)
17       endif
18       result = TheResult
19     )
20     prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtAlertID-is.pl"}
21   }
22 }
23 }
```

Listing C.31: Messir Spec. file primarytypes-datatypes-dtAlertID.msr.

C.32 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtCode.msr

```

1 /*
2 * @author 809279
3 * @date Tue Nov 15 04:44:05 MSK 2016
4 */
5
6 package icrash.operations.concepts.primarytypes.datatypes.dtCode {
7
8 import lu.uni.lassy.messir.libraries.primitives
9
10 Operation Model {
11     operation: icrash.concepts.primarytypes.datatypes.dtCode.is():ptBoolean{
12         postF{
13             let TheResult: ptBoolean in
14             let MaxLength: ptInteger in
15             ( if
16                 (generatedCode.value.length().eq(6))
17                 then (TheResult = true)
18                 else (TheResult = false)
19             endif
20             result = TheResult
21         )
22     }
23 }
24 }
25
26 }

```

Listing C.32: Messir Spec. file primarytypes-datatype-dtCode.msr.

C.33 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatype-primarytypes-dtComment.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtComment{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7     operation: icrash.concepts.primarytypes.datatypes.dtComment.is():ptBoolean{
8
9         postF{
10             let TheResult: ptBoolean in
11             ( if
12                 ( MaxLength = 160
13                   and AdtValue.value.length().leq(MaxLength)
14                 )
15                 then (TheResult = true)
16                 else (TheResult = false)
17             endif
18             result = TheResult
19         )
20     }
21     prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtComment-is.pl"}
22 }
23 }
24 }

```

Listing C.33: Messir Spec. file primarytypes-datatype-dtComment.msr.

C.34 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatype-primarytypes-dtCoordinatorID.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtCoordinatorID{
2
3 import lu.uni.lassy.messir.libraries.primitives
4

```

```

5 Operation Model {
6   operation: icrash.concepts.primarytypes.datatypes.dtCoordinatorID.is():ptBoolean{
7
8   postF{
9     let TheResult: ptBoolean in
10    ( if
11      ( AdtValue.value.length().gt(0)
12        and AdtValue.value.length().leq(5)
13      )
14      then (TheResult = true)
15      else (TheResult = false)
16    endif
17    result = TheResult
18  )
19 }
20 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtCoordinatorID-is.pl"
21 }
22 }
23 }
```

Listing C.34: Messir Spec. file primarytypes-datatypes-dtCoordinatorID.msr.

C.35 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtCrisisID.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtCrisisID{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtCrisisID.is():ptBoolean{
8
9   postF{
10    let TheResult: ptBoolean in
11    ( if
12      ( AdtValue.value.length().gt(0)
13        and AdtValue.value.length().leq(10)
14      )
15      then (TheResult = true)
16      else (TheResult = false)
17    endif
18    result = TheResult
19  )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtCrisisID-is.pl"}
22 }
23 }
24 }
```

Listing C.35: Messir Spec. file primarytypes-datatypes-dtCrisisID.msr.

C.36 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtGPSLocation-getGeographicalLocation.msr

```

1 package icrash.concepts.primarytypes.datatypes.operations.datatypes.dtGPSLocation.
2   getGeographicalLocation {
3
4 import lu.uni.lassy.messir.libraries.primitives
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.string
7 import lu.uni.lassy.messir.libraries.calendar
8 import icrash.concepts.primarytypes.datatypes
```

```

8 import icrash.concepts.primarytypes.classes
9 import icrash.concepts.secondarytypes.datatypes
10 import icrash.concepts.secondarytypes.classes
11
12 Operation Model {
13
14     operation: icrash.concepts.primarytypes.datatypes.dtGPSLocation.getGeographicalLocation(
15         EtGeographicalLocation:etGeographicalLocation):ptBoolean{
16             // include below the specification information (pre,post or ocl or prolog)
17         }
18     }
19 }

```

Listing C.36: Messir Spec. file primarytypes-datatypes-dtGPSLocation-getGeographicalLocation.msr.

C.37 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtGPSLocation.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtGPSLocation{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5
6 import icrash.concepts.primarytypes.datatypes
7 import icrash.concepts.primarytypes.classes
8 import icrash.concepts.secondarytypes.datatypes
9 import icrash.concepts.secondarytypes.classes
10
11 Operation Model {
12
13     operation: icrash.concepts.primarytypes.datatypes.dtGPSLocation.is():ptBoolean{
14         postF{
15             let TheResult: ptBoolean in
16             ( if
17                 ( AdtValue.latitude.is()
18                     and AdtValue.longitude.is
19                 )
20                 then (TheResult = true)
21                 else (TheResult = false)
22             endif
23             result = TheResult
24         )
25     }
26     prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtGPSLocation-is.pl"}
27 }
28     operation: icrash.concepts.primarytypes.datatypes.dtGPSLocation.isNearTo(aGPSLocation:
29         dtGPSLocation):ptBoolean{
30         postF{
31             let TheResult: ptBoolean in true
32             let EarthRadius: dtReal in
33             let MaxDistance: dtReal in
34             let ComparedLatitude: dtLatitude in
35             let ComparedLongitude: dtLongitude in
36             let R1: dtReal in let R1a: dtReal in
37             let R2: dtReal in let R2a: dtReal in
38
39             ( if
40                 ( EarthRadius.value = 6371
41                   and MaxDistance.value = 100
42
43                   and AdtValue.latitude = ComparedLatitude
44                   and AdtValue.longitude = ComparedLongitude
45                   and Self.latitude.sin() = R1a
46                   and AdtValue.latitude.sin().mul(R1a) = R1
47                   and Self.latitude.cos() = R2a
48                   and AdtValue.latitude.cos().mul(R2a) = R2

```

```

49     and AdtValue.longitude = ComparedLongitude
50     and Self.longitude.sub(ComparedLongitude).cos().mul(R2)
51         .add(R1).acos().mul(EarthRadius).sub(MaxDistance)
52         .value.leq(0)
53     )
54     then (TheResult = true)
55     else (TheResult = false)
56     endif
57     result = TheResult
58   )
59 }
60 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtGPSLocation-isNearTo
       .pl"}
61 }
62 operation: icrash.concepts.primarytypes.datatypes.dtLatitude.is():ptBoolean{
63 postF{
64   let TheResult: ptBoolean in
65   ( if
66     ( AdtValue.value.geq(-90.0)
67     and AdtValue.value.leq(+90.0)
68   )
69   then (TheResult = true)
70   else (TheResult = false)
71   endif
72   result = TheResult
73   ) )
74 prolog{ "src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLatitude-is.pl"}
75 }
76 operation: icrash.concepts.primarytypes.datatypes.dtLongitude.is():ptBoolean{
77 postF{
78   let TheResult: ptBoolean in
79   ( if
80     ( AdtValue.value.geq(-180.0)
81     and AdtValue.value.leq(+180.0)
82   )
83   then (TheResult = true)
84   else (TheResult = false)
85   endif
86   result = TheResult
87   ) )
88 prolog{ "src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLongitude-is.pl"}
89 }
90 }
91 }

```

Listing C.37: Messir Spec. file primarytypes-datatypes-dtGPSLocation.msr.

C.38 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtLogin.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtLogin{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtLogin.is():ptBoolean{
8     postF{
9       let TheResult: ptBoolean in
10      let MaxLength: ptInteger in
11      ( if
12        ( MaxLength = 20
13        and AdtValue.value.length().leq(MaxLength)
14      )
15      then (TheResult = true)
16      else (TheResult = false)
17      endif
18      result = TheResult

```

```

19      )
20    }
21  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLogin-is.pl"}
22 }
23 }
24 }
```

Listing C.38: Messir Spec. file primarytypes-datatatypes-dtLogin.msr.

C.39 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatatypes/primarytypes-datatatypes-dtPassword.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtPassword{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtPassword.is():ptBoolean{
8     postF{
9       let TheResult: ptBoolean in
10      let MinLength: ptInteger in
11      ( if
12        ( MinLength = 6
13          and AdtValue.value.length().geq(MinLength)
14        )
15        then (TheResult = true)
16        else (TheResult = false)
17      endif
18      result = TheResult
19    )
20  }
21  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtPassword-is.pl"}
22 }
23 }
24 }
```

Listing C.39: Messir Spec. file primarytypes-datatatypes-dtPassword.msr.

C.40 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatatypes/primarytypes-datatatypes-dtPhoneNumber.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtPhoneNumber{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtPhoneNumber.is():ptBoolean{
8
9     postF{
10       let TheResult: ptBoolean in
11       ( if
12         ( AdtValue.value.length().gt(4)
13           and AdtValue.value.length().leq(30)
14         )
15         then (TheResult = true)
16         else (TheResult = false)
17       endif
18       result = TheResult
19     )
20   }
21   prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtPhoneNumber-is.pl"}
22 }
23 }
```

24 }

Listing C.40: Messir Spec. file primarytypes-datatatypes-dtPhoneNumber.msr.

C.41 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etAlertStatus.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.etAlertStatus{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.etAlertStatus.is():ptBoolean{
8     postF{
9       let TheResult: ptBoolean in
10      ( if
11        ( self = pending
12        or self = valid
13        or self = invalid
14      )
15      then (TheResult = true)
16      else (TheResult = false)
17      endif
18      result = TheResult
19    )
20  }
21 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etAlertStatus-is.pl"}
22 }
23 }
24 }
```

Listing C.41: Messir Spec. file primarytypes-datatypes-etAlertStatus.msr.

C.42 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etCrisisStatus.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.etCrisisStatus{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.etCrisisStatus.is():ptBoolean{
8     postF{
9       let TheResult: ptBoolean in
10      ( if
11        ( self = pending
12        or self = handled
13        or self = solved
14        or self = closed
15      )
16      then (TheResult = true)
17      else (TheResult = false)
18      endif
19      result = TheResult
20    )
21  }
22 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etCrisisStatus-is.pl"}
23 }
24 }
```

Listing C.42: Messir Spec. file primarytypes-datatypes-etCrisisStatus.msr.

C.43 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatatypes-etCrisisType.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.etCrisisType{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7     operation: icrash.concepts.primarytypes.datatypes.etCrisisType.is():ptBoolean{
8         postF{
9             let TheResult: ptBoolean in
10            ( if
11                ( self = critical
12                or self = medium
13                or self = high
14                or self = low
15            )
16            then (TheResult = true)
17            else (TheResult = false)
18        endif
19        result = TheResult
20    }
21 }
22 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etCrisisType-is.pl"}
23 }
24 }
25 }
```

Listing C.43: Messir Spec. file primarytypes-datatypes-etCrisisType.msr.

C.44 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etGeographicalLocation.msr

```

1 /*
2 * @author 809279
3 * @date Tue Nov 15 04:54:56 MSK 2016
4 */
5
6 package icrash.operations.concepts.primarytypes.datatypes.etGeographicalLocation {
7
8 import lu.uni.lassy.messir.libraries.primitives
9
10 Operation Model {
11     operation: icrash.concepts.primarytypes.datatypes.etGeographicalLocation.is():ptBoolean{
12         postF{
13             let TheResult: ptBoolean in
14             ( if
15                 ( self = central
16                 or self = southEastern
17                 or self = southWestern
18                 or self = northEastern
19                 or self = northWestern
20             )
21             then (TheResult = true)
22             else (TheResult = false)
23         endif
24         result = TheResult
25     }
26 }
27 // prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-
28 etGeographicalLocation-is.pl"}
29 }
30 }
```

31 }

Listing C.44: Messir Spec. file primarytypes-datatatypes-etGeographicalLocation.msr.

C.45 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etHumanKind.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.etHumanKind{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.ethumanKind.is():ptBoolean{
8     postF{
9       let TheResult: ptBoolean in
10      ( if
11        ( self = witness
12        or self = victim
13        or self = anonymous
14      )
15      then (TheResult = true)
16      else (TheResult = false)
17      endif
18      result = TheResult
19    }
20  prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etHumanKind-is.pl"}
21 }
22 }
23 }
```

Listing C.45: Messir Spec. file primarytypes-datatypes-etHumanKind.msr.

C.46 File ./src-gen/messir-spec/concepts/primarytypes-datatypes.msr

```

1 package icrash.concepts.primarytypes.datatypes {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.string
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Concept Model {
9
10 Primary Types {
11
12   datatype dtAlertID extends dtString {
13     operation is():ptBoolean
14   }
15   datatype dtCrisisID extends dtString {
16     operation is():ptBoolean
17   }
18   datatype dtLogin extends dtString {
19     operation is():ptBoolean
20   }
21   datatype dtPassword extends dtString {
22     operation is():ptBoolean
23   }
24   datatype dtCode{
25     attribute generatedCode:dtString
26     operation is():ptBoolean
27   }
28   datatype dtCoordinatorID extends dtString {
29     operation is():ptBoolean
30   }
```

```

31  datatype dtPhoneNumber extends dtString {
32    operation is():ptBoolean
33  }
34  datatype dtComment extends dtString {
35    operation is():ptBoolean
36  }
37  datatype dtLatitude extends dtReal {
38    operation is():ptBoolean
39  }
40  datatype dtLongitude extends dtReal {
41    operation is():ptBoolean
42  }
43  datatype dtGPSLocation {
44    attribute latitude: dtLatitude
45    attribute longitude: dtLongitude
46    operation is():ptBoolean
47    operation isNearTo(AGPSLocation:dtGPSLocation ):ptBoolean
48    operation getGeographicalLocation(EtGeographicalLocation:etGeographicalLocation):ptBoolean
49  }
50
51  enum etCrisisStatus {
52    constants["pending", "handled", "solved","closed"]
53    operation is():ptBoolean
54  }
55  enum etAlertStatus {
56    constants["pending", "valid", "invalid"]
57    operation is():ptBoolean
58  }
59  enum etCrisisType {
60    constants["critical", "low","high","medium"]
61    operation is():ptBoolean
62  }
63  enum etGeographicalLocation {
64    constants["central", "southEastern", "northEastern", "southWestern", "northWestern"]
65    operation is():ptBoolean
66  }
67  enum etHumanKind {
68    constants["witness", "victim", "anonymous"]
69    operation is():ptBoolean
70  }
71 }
72 }
73 }
```

Listing C.46: Messir Spec. file primarytypes-datatatypes.msr.

C.47 File ./src-gen/messir-spec/concepts/secondarytypes- associations.msr

```

1 package icrash.concepts.secondarytypes.associations {
2
3 Concept Model {
4
5   Secondary Types{
6
7   }
8 }
9 }
```

Listing C.47: Messir Spec. file secondarytypes-associations.msr.

C.48 File ./src-gen/messir-spec/concepts/secondarytypes- classes.msr

```

1 package icrash.concepts.secondarytypes.classes {
2
```

```

3 Concept Model {
4
5 Secondary Types{
6
7 }
8 }
9 }
```

Listing C.48: Messir Spec. file secondarytypes-classes.msr.

C.49 File ../src-gen/messir-spec/concepts/secondarytypes-datatatypes.msr

```

1 package icrash.concepts.secondarytypes.datatypes {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.string
5
6 import icrash.concepts.primarytypes.datatypes
7
8 Concept Model {
9
10 Secondary Types {
11
12 datatype dtSMS {
13     attribute value: ptString
14     operation is():ptBoolean
15 }
16 }
17 }
18 }
```

Listing C.49: Messir Spec. file secondarytypes-datatypes.msr.

C.50 File ../src-gen/messir-spec/usecases/subfunctions-usecases.msr

```

1 package icrash.usecases.subfunctions {
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7 import icrash.concepts.secondarytypes.datatypes
8 import lu.uni.lassy.messir.libraries.primitives
9 import lu.uni.lassy.messir.libraries.math
10 import lu.uni.lassy.messir.libraries.calendar
11 import lu.uni.lassy.messir.libraries.string
12
13 import icrash.environment
14
15 Use Case Model {
16
17 //-----
18 use case system subfunction oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID, AdtLogin:dtLogin,
19     AdtPassword:dtPassword, AdtPhoneNumber:dtPhoneNumber, AetGeographicalLocation:
20     etGeographicalLocation, AetCrisisType:etCrisisType) {
21     actor actAdministrator[primary,active]
22     returned messages {
23         ieCoordinatorAdded() returned to actAdministrator
24     }
25 //-
26 use case system subfunction oeAlert(
27     AetKind:etHumanKind,
28     AdtMyDate:dtDate,
29     AdtTime:dtTime,
30     AdtPhoneNumber:dtPhoneNumber,
```

```

30             AdtGPSLocation:dtGPSLocation,
31             AdtComment:dtComment,
32             AetCrisisType: etCrisisType) {
33     actor actComCompany[primary,active]
34     returned messages {
35         ieSmsSend(AdtPhoneNumber,AdtSMS) returned to actComCompany
36     }
37 }
38 /**
39 use case system subfunction oeInvalidateAlert(AdtAlertID:dtAlertID) {
40     actor actCoordinator[primary,active]
41     actor actComCompany[secondary,passive]
42     returned messages {
43         ieMessage(AMessage) returned to actCoordinator
44     }
45 }
46 /**
47 use case system subfunction oeCloseCrisis(AdtCrisisID:dtCrisisID) {
48     actor actCoordinator[primary,active]
49     returned messages {
50         ieMessage(AMessage) returned to actCoordinator
51     }
52 /**
53 use case system subfunction oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger) {
54     actor actMsrCreator[primary,active]
55 }
56 /**
57 use case system subfunction oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID) {
58     actor actAdministrator[primary,active]
59     returned messages {
60         ieCoordinatorDeleted() returned to actAdministrator
61     }
62 }
63
64 use case system subfunction oeEditCoordinator(AdtCoordinatorID:dtCoordinatorID, AetCrisisType:
65             etCrisisType, AetGeographicalLocation: etGeographicalLocation) {
66     actor actAdministrator[primary,active]
67     returned messages {
68         ieCoordinatorEdited() returned to actAdministrator
69     }
70 /**
71 use case system subfunction oeGetAlertsSet(AetAlertStatus:etAlertStatus) {
72     actor actCoordinator[primary,active]
73     returned messages {
74         ieSendAnAlert(ActAlert) returned to actCoordinator
75     }
76 }
77 /**
78 use case system subfunction oeGetCrisisSet(AetCrisisStatus:etCrisisStatus) {
79     actor actCoordinator[primary,active]
80     returned messages {
81         ieSendACrisis(ActCrisis) returned to actCoordinator
82     }
83 }
84 /**
85 use case system subfunction oeSetCrisisHandler(AdtCrisisID:dtCrisisID) {
86     actor actCoordinator[primary,active]
87     actor actCoordinator[secondary,passive]
88     actor actComCompany[secondary,passive,multiple]
89     returned messages {
90         ieMessage(AMessage)
91         returned to actCoordinator
92         ieSendAnAlert(ActAlert)
93         returned to actCoordinator
94         ieSmsSend(AdtPhoneNumber,AdtSMS)
95         returned to actComCompany
96     }
97 }
98 /**

```

```

99  use case system subfunction oeLogin(AdtLogin:dtLogin , AdtPassword:dtPassword) {
100    actor actAuthenticated[primary,active]
101    returned messages {
102      ieMessage(AMessage) returned to actAuthenticated
103    }
104  }
105 //-----
106 use case system subfunction oeLogout() {
107   actor actAuthenticated[primary,active]
108   returned messages {
109     ieMessage(AMessage) returned to actAuthenticated
110   }
111 }
112
113 use case system subfunction oeSMS(AdtString: dtString) {
114   actor actAuthenticated[primary,active]
115   returned messages {
116     ieMessage(AMessage) returned to actAuthenticated
117   }
118 }
119
120 //-----
121 use case system subfunction oeReportOnCrisis(AdtCrisisID:dtCrisisID,AdtComment:dtComment) {
122   actor actCoordinator[primary,active]
123   returned messages {
124     ieMessage(AMessage) returned to actCoordinator
125   }
126 }
127 //-----
128 use case system subfunction oeSetClock(AcurrentClock:dtDateAndTime) {
129   actor actActivator[primary,proactive]
130 }
131 //-----
132 use case system subfunction oeSetCrisisStatus(AdtCrisisID:dtCrisisID ,AetCrisisStatus:
133   etCrisisStatus) {
134   actor actCoordinator[primary,active]
135   returned messages {
136     ieMessage(AMessage) returned to actCoordinator
137   }
138
139 use case system subfunction oeSetCrisisType(AdtCrisisID:dtCrisisID ,AetCrisisStatus:etCrisisStatus
140   ) {
141   actor actCoordinator[primary,active]
142   returned messages {
143     ieMessage(AMessage) returned to actCoordinator
144   }
145 //-----
146 use case system subfunction oeSollicitateCrisisHandling() {
147   actor actActivator[primary,proactive]
148   actor actCoordinator[secondary,passive,multiple]
149   actor actAdministrator[secondary,passive]
150   returned messages {
151     ieMessage(AMessage) returned to actCoordinator
152     //ieMessage(AMessage) returned to actAdministrator
153   }
154 }
155 //-----
156 use case system subfunction oeValidateAlert(AdtAlertID:dtAlertID) {
157   actor actCoordinator[primary,active]
158   returned messages {
159     ieMessage(AMessage) returned to actCoordinator
160   }
161 }
162 }
163
164 }
```

Listing C.50: Messir Spec. file subfunctions-usecases.msr.

C.51 File ./src-gen/messir-spec/test/tc-testcase01.msr

```

1 package lu.uni.lassy.excalibur.examples.icrash.tests.testcase01 {
2
3 import lu.uni.lassy.messir.libraries.string
4 import lu.uni.lassy.messir.libraries.primitives
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.associations
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.primarytypes.datatypes
11 import icrash.concepts.secondarytypes.datatypes
12 import icrash.environment
13
14 Test Model{
15   test case testcase01 order 01 {
16   //-----
17   test step ts01oeCreateSystemAndEnvironment order 01 {
18     variables{
19       Creator:actMsrCreator
20       AqtyComCompanies: ptInteger
21     }
22     constraints{
23       AqtyComCompanies = 4
24     }
25     test message{
26       out:Creator sends to system actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment(
27         AqtyComCompanies)
28     }
29     oracle{
30       constraints{
31         true
32       }
33     prolog{"src/Tests/system/01/system-sim-01-01-oeCreateSystemAndEnvironment.pl"}
34   }
35   //-----
36   test step ts02oeSetClock order 02{
37     variables{
38       TheActor:actActivator
39       ACurrentClock:dtDateAndTime
40     }
41     constraints{
42       TheActor=TheSystem.rnactActivator->any2(true)
43
44       ACurrentClock.date.year.value = 2017
45       ACurrentClock.date.month.value = 11
46       ACurrentClock.date.day.value = 24
47       ACurrentClock.time.hour.value = 15
48       ACurrentClock.time.minute.value = 20
49       ACurrentClock.time.second.value = 00
50     }
51     test message{
52       out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
53     }
54     oracle{
55       constraints{
56         true
57       }
58     }
59   }
60   //-----
61
62 test step ts03oeLogin order 03{
63   variables{
64     TheActor : actAdministrator
65     AdtLogin:dtLogin
66     AdtPassword:dtPassword
67   }

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68  constraints{
69      TheActor=TheSystem.rnactAdministrator->any2(true)
70      AdtLogin.value.eq('icrashadmin')
71      AdtPassword.value.eq('7WXC1359')
72  }
73  test message{
74      out:TheActor sends to system actAdministrator.outactAdministrator.oeLogin(AdtLogin,AdtPassword)
75  }
76  oracle{
77      variables{
78          AMesssage:ptString
79      }
80      constraints{
81          AMesssage = 'You are logged ! Welcome ...'
82          TheActor.inactAdministrator.ieMessage(AMesssage)
83      }
84  }
85  }
86 //-----
87 test step ts04oeAddCoordinator order 04{
88      variables{
89          TheActor : actAdministrator
90          AdtCoordinatorID : dtCoordinatorID
91          AdtLogin:dtLogin
92          AdtPassword:dtPassword
93      }
94      constraints{
95          TheActor = TheSystem.rnactAdministrator->any2(true)
96          AdtCoordinatorID.value.eq('1')
97          AdtLogin.value.eq('steve')
98          AdtPassword.value.eq('pwdMessirExcalibur2017')
99      }
100     test message{
101         out:TheActor
102         sends to system actAdministrator.outactAdministrator.oeAddCoordinator
103             (AdtCoordinatorID,
104             AdtLogin,
105             AdtPassword)
106     }
107     oracle{
108         constraints{
109             TheActor.inactAdministrator.ieCoordinatorAdded()
110         }
111     }
112 }
113 //-----
114 test step ts05oeLogout order 05{
115     variables{
116         TheActor : actAdministrator
117     }
118     constraints{
119         TheActor = TheSystem.rnactAdministrator->any2(true)
120     }
121     test message{
122         out:TheActor sends to system actAdministrator.outactAdministrator.oeLogout()
123     }
124     oracle{
125         variables{
126             AMesssage:ptString
127         }
128         constraints{
129             AMesssage = 'You are logged out ! Good Bye ...'
130             TheActor.inactAdministrator.ieMessage(AMesssage)
131         }
132     }
133 }
134 //-----
135 test step ts06oeSetClock02 order 06{
136     variables{
137         TheActor:actActivator

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138     ACurrentClock:dtDateAndTime
139   }
140   constraints{
141     TheActor=TheSystem.rnactActivator->any2(true)
142     ACurrentClock.date.year.value = 2017
143     ACurrentClock.date.month.value = 11
144     ACurrentClock.date.day.value = 26
145     ACurrentClock.time.hour.value = 10
146     ACurrentClock.time.minute.value = 15
147     ACurrentClock.time.second.value = 00
148   }
149   test message{
150     out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
151   }
152   oracle{
153     constraints{
154       true
155     }
156   }
157 }
158 //-----
159 test step ts07oeAlert1 order 07{
160   variables{
161     TheActor : actComCompany
162     AetHumanKind:etHumanKind
163     AdtDate:dtDate
164     AdtTime:dtTime
165     AdtPhoneNumber:dtPhoneNumber
166     AdtGPSLocation:dtGPSLocation
167     AdtComment:dtComment
168   }
169   constraints{
170     TheActor = TheSystem.rnactComCompany->any2(true)
171     AetHumanKind = witness
172     AdtDate.year.value = 2017
173     AdtDate.month.value = 11
174     AdtDate.day.value = 26
175     AdtTime.hour.value = 10
176     AdtTime.minute.value = 10
177     AdtTime.second.value = 16
178     AdtPhoneNumber.value = '+3524666445252'
179     AdtGPSLocation.latitude.value = 49.627675
180     AdtGPSLocation.longitude.value = 6.159590
181     AdtComment.value = '3 cars involved in an accident.'
182   }
183   test message{
184     out:TheActor
185     sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
186                               AdtDate,
187                               AdtTime,
188                               AdtPhoneNumber,
189                               AdtGPSLocation,
190                               AdtComment)
191   }
192   oracle{
193     variables{
194       AdtSMS:dtSMS
195     }
196     constraints{
197       AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
198       TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
199     }
200   }
201 }
202 //-----
203 test step ts08oeSetClock03 order 08{
204   variables{
205     TheActor:actActivator
206     ACurrentClock:dtDateAndTime
207   }

```

```

208 constraints{
209     TheActor=TheSystem.rnactActivator->any2(true)
210     ACurrentClock.date.year.value = 2017
211     ACurrentClock.date.month.value = 11
212     ACurrentClock.date.day.value = 26
213     ACurrentClock.time.hour.value = 10
214     ACurrentClock.time.minute.value = 30
215     ACurrentClock.time.second.value = 00
216 }
217 test message{
218     out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
219 }
220 oracle{
221     constraints{
222         true
223     }
224 }
225 }
226 //-----
227 test step ts09oeSollicitateCrisisHandling order 09{
228     variables{
229         TheActor : actActivator
230     }
231     constraints{
232         TheActor = TheSystem.rnactActivator->any2(true)
233     }
234     test message{
235         out:TheActor sends to system actActivator.outactActivator.oeSollicitateCrisisHandling()
236     }
237     oracle{
238         variables{
239             TheAdministrator:actAdministrator
240             TheCoordinator:actCoordinator
241             AMesssageForCrisisHandlers:ptString
242         }
243         constraints{
244             TheAdministrator = TheSystem.rnactAdministrator->any2(true)
245             TheCoordinator = TheSystem.rnactCoordinator->any2(true)
246             AMesssageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
REACT !'
247
248             TheAdministrator.inactAdministrator.ieMessage(AMesssageForCrisisHandlers)
249             TheCoordinator.inactAdministrator.ieMessage(AMesssageForCrisisHandlers)
250
251 /* this oracle should be written like this:
252
253     oracle{
254         variables{
255             TheAdministrator:actAdministrator
256             AMesssageForCrisisHandlers:ptString
257         }
258         constraints{
259             AMesssageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
REACT !'
260             TheAdministrator = TheSystem.rnactAdministrator->any2(true)
261
262             TheSystem.rnactCoordinator->forAll(TheCoordinator:actCoordinator | TheCoordinator.
actAuthenticated.inactAuthenticated.ieMessage(AMesssage))
263
264         // receives from system is for step instances
265
266     */
267 }
268 }
269 }
270 //-----
271 test step ts10oeLogin02 order 10{
272     variables{
273         TheActor : actCoordinator
274         AdtLogin:dtLogin

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275     AdtPassword:dtPassword
276   }
277   constraints{
278     TheActor = TheSystem.rnactCoordinator->select(a | a.rnctCoordinator.login.value.eq('steve'))->
279     any2(true)
280     AdtLogin.value.eq('steve')
281     AdtPassword.value.eq('pwdMessirExcalibur2017')
282   }
283   test message{
284     out:TheActor sends to system actAuthenticated.outactAuthenticated.oeLogin(AdtLogin,AdtPassword)
285   }
286   oracle{
287     variables{
288       AMesssage:ptString
289     }
290     constraints{
291       AMesssage = 'You are logged ! Welcome ...'
292       TheActor.inactAuthenticated.ieMessage(AMesssage)
293     }
294   }
295 //-----
296 test step ts11oeGetCrisisSet order 11{
297   variables{
298     TheActor : actCoordinator
299     AetCrisisStatus : etCrisisStatus
300   }
301   constraints{
302     TheActor=TheSystem.rnactCoordinator
303     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
304     ->any2(true)
305     AetCrisisStatus = pending
306   }
307   test message{
308     out:TheActor sends to system actCoordinator.outactCoordinator.oeGetCrisisSet(AetCrisisStatus)
309   }
310   oracle{
311 //TODO - make consistent with test step implementation by adding Prolog code for input messages
312   variables{
313     ActCrisis:ctCrisis
314   }
315   constraints{
316     TheActor.inactCoordinator.ieSendACrisis(ActCrisis)
317   }
318 }
319 }
320 //-----
321 test step ts12oeSetCrisisHandler order 12{
322   variables{
323     TheActor : actCoordinator
324     AdtCrisisID : dtCrisisID
325   }
326   constraints{
327     TheActor=TheSystem.rnactCoordinator
328     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
329     ->any2(true)
330     //and AdtCrisisID.value= '1'
331   }
332   test message{
333     out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisHandler(AdtCrisisID)
334   }
335   oracle{
336     variables{
337       AMesssage:ptString
338       AdtPhoneNumber:dtPhoneNumber
339       AdtSMS:dtSMS
340       ActAlert:ctAlert
341
342       TheComCompany: actComCompany
343       TheCoordinator:actCoordinator

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344     }
345     constraints{
346         AMessage = 'You are now considered as handling the crisis !'
347         AdtSMS.value = 'The handling of your alert by our services is in progress !'
348         TheComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
349         TheCoordinator.inactCoordinator.ieSendAnAlert(ActAlert)
350         TheActor.inactAuthenticated.ieMessage(AMessage)
351     }
352 }
353 }
354 //-----
355 test step ts13oeSetClock04 order 13{
356     variables{
357         TheActor:actActivator
358         ACurrentClock:dtDateAndTime
359     }
360     constraints{
361         TheActor=TheSystem.rnactActivator->any2(true)
362         ACurrentClock.date.year.value = 2017
363         ACurrentClock.date.month.value = 11
364         ACurrentClock.date.day.value = 26
365         ACurrentClock.time.hour.value = 10
366         ACurrentClock.time.minute.value = 45
367         ACurrentClock.time.second.value = 00
368     }
369     test message{
370         out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
371     }
372     oracle{
373         constraints{
374             true
375         }
376     }
377 }
378 //-----
379 test step ts14oeValidateAlert order 14{
380     variables{
381         TheActor : actCoordinator
382         AdtAlertID : dtAlertID
383     }
384     constraints{
385         TheActor=TheSystem.rnactCoordinator
386         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
387         ->any2(true)
388         //and AdtAlertID.value= '1'
389     }
390     test message{
391         out:TheActor sends to system actCoordinator.outactCoordinator.oeValidateAlert(AdtAlertID)
392     }
393     oracle{
394         variables{
395             AMessage:ptString
396         }
397         constraints{
398             AMessage = 'The Alert is now declared as valid !'
399             TheActor.actAuthenticated.inactAuthenticated.ieMessage(AMessage)
400         }
401     }
402 }
403 //-----
404 test step ts15oeAlert2 order 15{
405     variables{
406         TheActor : actComCompany
407         AetHumanKind:etHumanKind
408         AdtDate:dtDate
409         AdtTime:dtTime
410         AdtPhoneNumber:dtPhoneNumber
411         AdtGPSLocation:dtGPSLocation
412         AdtComment:dtComment
413     }

```

```

414 constraints{
415     TheActor = TheSystem.rnactComCompany->any2(true)
416     AetHumanKind = witness
417     AdtDate.year.value = 2017
418     AdtDate.month.value = 11
419     AdtDate.day.value = 26
420     AdtTime.hour.value = 10
421     AdtTime.minute.value = 20
422     AdtTime.second.value = 00
423     AdtPhoneNumber.value = '+3524666445000'
424     AdtGPSLocation.latitude.value = 49.627095
425     AdtGPSLocation.longitude.value = 6.160251
426     AdtComment.value = 'A car crash just happened.'
427 }
428 test message{
429     out:TheActor
430     sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
431             AdtDate,
432             AdtTime,
433             AdtPhoneNumber,
434             AdtGPSLocation,
435             AdtComment)
436 }
437 oracle{
438     variables{
439         AdtSMS:dtSMS
440     }
441     constraints{
442         AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
443         TheActor.actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
444     }
445 }
446 }
447 //-----
448 test step ts16oeSetClock05 order 16{
449     variables{
450         TheActor:actActivator
451         ACurrentClock:dtDateAndTime
452     }
453     constraints{
454         TheActor=TheSystem.rnactActivator->any2(true)
455         ACurrentClock.date.year.value = 2017
456         ACurrentClock.date.month.value = 11
457         ACurrentClock.date.day.value = 26
458         ACurrentClock.time.hour.value = 12
459         ACurrentClock.time.minute.value = 45
460         ACurrentClock.time.second.value = 00
461     }
462     test message{
463         out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
464     }
465     oracle{
466         constraints{
467             true
468         }
469     }
470 }
471 //-----
472 test step ts17oeSetCrisisStatus order 17{
473     variables{
474         TheActor : actCoordinator
475         AdtCrisisID : dtCrisisID
476         AetCrisisStatus : etCrisisStatus
477     }
478     constraints{
479         TheActor=TheSystem.rnactCoordinator
480         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
481         ->any2(true)
482         //and AdtCrisisID.value= '1'
483         //and AetCrisisStatus = solved

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484     }
485 
486     test message{
487         out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisStatus(AdtCrisisID,
488         AdtCrisisStatus)
489     }
490 
491     oracle{
492         variables{
493             AMessage:ptString
494         }
495         constraints{
496             AMessage = 'The crisis status has been updated !'
497             TheActor.inactAuthenticated.ieMessage(AMessage)
498         }
499     }
500 
501 //-----
502 
503     test step ts18oeReportOnCrisis order 18{
504         variables{
505             TheActor : actCoordinator
506             AdtCrisisID : dtCrisisID
507             AdtComment : dtComment
508         }
509         constraints{
510             TheActor=TheSystem.rnactCoordinator
511             ->select(a | a.rnctCoordinator.login.value.eq('steve'))
512             ->any2(true)
513             //and AdtCrisisID.value= '1'
514             //and AdtComment.value = '3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
515             mobilized'
516         }
517         test message{
518             out:TheActor sends to system actCoordinator.outactCoordinator.oeReportOnCrisis(AdtCrisisID,
519             AdtComment)
520         }
521         oracle{
522             variables{
523                 AMessage:ptString
524             }
525             constraints{
526                 AMessage = 'The crisis comment has been updated !'
527                 TheActor.inactAuthenticated.ieMessage(AMessage)
528             }
529         }
530     }
531 
532 //-----
533 
534     test step ts19oeCloseCrisis order 19{
535         variables{
536             TheActor : actCoordinator
537             AdtCrisisID : dtCrisisID
538         }
539         constraints{
540             TheActor=TheSystem.rnactCoordinator
541             ->select(a | a.rnctCoordinator.login.value.eq('steve'))
542             ->any2(true)
543             //and AdtCrisisID.value= '1'
544         }
545         test message{
546             out:TheActor sends to system actCoordinator.outactCoordinator.oeCloseCrisis(AdtCrisisID)
547         }
548         oracle{
549             variables{
550                 AMessage:ptString
551             }
552             constraints{
553                 AMessage = 'The crisis is now closed !'
554                 TheActor.inactAuthenticated.ieMessage(AMessage)
555             }
556         }
557     }
558 }
```

```
551 }
552 }
```

Listing C.51: Messir Spec. file tc-testcase01.msr.

C.52 File ./src-gen/messir-spec/test/tci-testcase01-instance01.msr

```
1 package lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01 {
2
3 import lu.uni.lassy.messir.libraries.string
4 import lu.uni.lassy.messir.libraries.primitives
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.associations
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.primarytypes.datatypes
11 import lu.uni.lassy.excalibur.examples.icrash.tests.testcase01
12 import icrash.environment
13
14 Test Model {
15 test case instance instance01: testcase01{
16 /**
17 test step instance tsi01: testcase01.ts01oeCreateSystemAndEnvironment{
18 variables {
19     theCreator: testcase01.ts01oeCreateSystemAndEnvironment.Creator = "theCreator"
20     AqtyComCompanies : testcase01.ts01oeCreateSystemAndEnvironment.AqtyComCompanies="4"
21   }
22 oracle {
23     satisfaction = "true"
24   }
25 test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
26 }
27 /**
28 test step instance tsi02: testcase01.ts02oeSetClock{
29 variables {
30     theClock: testcase01.ts02oeSetClock.TheActor = "theClock"
31     ACurrentClock : testcase01.ts02oeSetClock.ACurrentClock= "2017:11:24 - 03:20:00"
32   }
33 oracle {
34     satisfaction = "true"
35   }
36 test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
37 }
38 /**
39 test step instance tsi03: testcase01.ts03oeLogin{
40 variables {
41     bill: testcase01.ts03oeLogin.TheActor="bill"
42     AdtLogin : testcase01.ts03oeLogin.AdtLogin= "icrashadmin"
43     AdtPassword : testcase01.ts03oeLogin.AdtPassword= "7WXC1359"
44   }
45 oracle {
46     satisfaction = "true"
47     received message {
48       AMesssage : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ... '
49       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
50     }
51   }
52 test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
53 }
54 /**
55 test step instance tsi04: testcase01.ts04oeAddCoordinator{
56 variables {
57   reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
58   AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
59   AdtLogin : testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
60   AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
61 }
62 oracle {
```

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63     satisfaction = "true"
64     received message {
65       tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
66     }
67   }
68   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
69 }
70 //-----
71 test step instance tsi05: testcase01.ts05oeLogout{
72   variables {
73     reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
74   }
75   oracle {
76     satisfaction = "true"
77     received message {
78       AMesssage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
79       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
80     }
81   }
82   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
83 }
84 //-----
85 test step instance tsi06: testcase01.ts06oeSetClock02{
86   variables {
87     reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
88     ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
89   }
90   oracle {
91     satisfaction = "true"
92   }
93   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
94 }
95 //-----
96 test step instance tsi07: testcase01.ts07oeAlert1{
97   variables {
98     tango:testcase01.ts07oeAlert1.TheActor ="tango"
99     AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
100    AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
101    AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
102    AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
103    AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
104    AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
105  }
106  oracle {
107    satisfaction = "true"
108    received message {
109      AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and
keep you informed'
110      tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
111    }
112  }
113 }
114   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
115 }
116
117 //-----
118 test step instance tsi08: testcase01.ts08oeSetClock03{
119   variables {
120     reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrentClock
121     ACurrentClock : testcase01.ts08oeSetClock03.ACurrentClock = "2017:11:26 - 10:30:00"
122   }
123   oracle {
124     satisfaction = "true"
125   }
126   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
127 }
128 //-----
129 test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
130   variables {
131     reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor

```

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132     steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
133     reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
134   }
135   oracle {
136     satisfaction = "true"
137     received message {
138       AMessageForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
139       AMessageForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please
140       REACT !'
141       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
142         AMessageForCrisisHandlers)
143       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
144         AMessageForCrisisHandlers)
145     }
146   }
147 //-----
148 test step instance ts10: testcase01.ts10oeLogin02{
149   variables {
150     reuse tsi09.steve as testcase01.ts10oeLogin02.TheActor
151     AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
152     AdtPassword : testcase01.ts10oeLogin02.AdtPassword= "pwdMessirExcalibur2017"
153   }
154   oracle {
155     satisfaction = "true"
156     received message {
157       AMessage : testcase01.ts10oeLogin02.AMessage= 'You are logged ! Welcome ...'
158       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
159     }
160   }
161 }
162 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
163 }
164 //-----
165 test step instance ts11: testcase01.ts11oeGetCrisisSet{
166   variables {
167     reuse tsi09.steve as testcase01.ts11oeGetCrisisSet.TheActor
168     AetCrisisStatus : testcase01.ts11oeGetCrisisSet.AetCrisisStatus = "pending"
169   }
170   oracle {
171     satisfaction = "true"
172     received message {
173       ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
174       tsi09.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
175     }
176   }
177   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
178 }
179 //-----
180 test step instance ts12: testcase01.ts12oeSetCrisisHandler{
181   variables {
182     reuse tsi09.steve as testcase01.ts12oeSetCrisisHandler.TheActor
183     AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
184   }
185   reuse tsi07.tango as testcase01.ts12oeSetCrisisHandler.TheComCompany
186   }
187 }
188 oracle {
189   satisfaction = "true"
190   received message {
191     AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
192     crisis !'
193     AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
194       is in progress !'
195     AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
196     tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)

```

```

196     tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
197     }
198   }
199 }
200 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
201 }
202 //-----
203 test step instance tsi13: testcase01.ts13oeSetClock04{
204   variables {
205     reuse tsi02.theClock as testcase01.ts13oeSetClock04.TheActor
206     ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
207   }
208   oracle {
209     satisfaction = "true"
210   }
211 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
212   }
213 //-----
214 test step instance tsi14: testcase01.ts14oeValidateAlert{
215   variables {
216     reuse tsi09.steve as testcase01.ts14oeValidateAlert.TheActor
217     AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
218   }
219   oracle {
220     satisfaction = "true"
221     received message {
222       AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
223       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
224     }
225   }
226   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
227   }
228 }
229 //-----
230 test step instance tsi15: testcase01.ts15oeAlert2{
231   variables {
232     reuse tsi07.tango as testcase01.ts15oeAlert2.TheActor
233     AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
234     AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
235     AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
236     AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
237     AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
238     AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
239   }
240   message {
241     tsi07.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert(
242       AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
243   }
244   oracle {
245     satisfaction = "true"
246     received message {
247       AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
248         keep you informed'
249       tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
250     }
251   }
252   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
253   }
254 //-----
255 test step instance tsi16: testcase01.ts16oeSetClock05{
256   variables {
257     reuse tsi02.theClock as testcase01.ts16oeSetClock05.TheActor
258     ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
259   }
260   oracle {
261     satisfaction = "true"
262     received message {
263

```

```

264     }
265   }
266   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
267 }
268 //-----
269 test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
270   variables {
271     reuse tsi09.steve as testcase01.ts17oeSetCrisisStatus.TheActor
272     AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
273     AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
274   }
275   oracle {
276     satisfaction = "true"
277     received message {
278       AMesssage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
279       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
280     }
281   }
282   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
283 }
284 //-----
285 test step instance tsi18: testcase01.ts18oeReportOnCrisis{
286   variables {
287     reuse tsi09.steve as testcase01.ts18oeReportOnCrisis.TheActor
288     AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
289     AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
290     evacuated and 4 rescue unit mobilized"
291   }
292   oracle {
293     satisfaction = "true"
294     received message {
295       AMesssage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
296       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
297     }
298   }
299   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
300 }
301 //-----
302 test step instance tsi19: testcase01.ts19oeCloseCrisis{
303   variables {
304     reuse tsi09.steve as testcase01.ts19oeCloseCrisis.TheActor
305     AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
306   }
307   oracle {
308     satisfaction = "true"
309     received message {
310       AMesssage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
311       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
312     }
313   }
314 }
315 }
316   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
317 }
318
319 }
320 //-----
321 //-----
322 //-----
323 test case instance instance01Part01:testcase01{
324 //-----
325   test step instance tsi01:testcase01.ts01oeCreateSystemAndEnvironment{
326     variables {
327       theCreator:testcase01.ts01oeCreateSystemAndEnvironment.Creator = "theCreator"
328       AqtyComCompanies : testcase01.ts01oeCreateSystemAndEnvironment.AqtyComCompanies="4"
329     }
330     oracle {
331       satisfaction = "true"
332     }

```

```

333     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
334   }
335 /**
336 test step instance tsi02: testcase01.ts02oeSetClock{
337   variables {
338     theClock:testcase01.ts02oeSetClock.TheActor = "theClock"
339     ACurrentClock : testcase01.ts02oeSetClock.ACurrentClock= "2017:11:24 - 03:20:00"
340   }
341   oracle {
342     satisfaction = "true"
343   }
344   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
345 }
346 /**
347 test step instance tsi03: testcase01.ts03oeLogin{
348   variables {
349     bill:testcase01.ts03oeLogin.TheActor="bill"
350     AdtLogin : testcase01.ts03oeLogin.AdtLogin= "icrashadmin"
351     AdtPassword : testcase01.ts03oeLogin.AdtPassword= "7WXC1359"
352   }
353   oracle {
354     satisfaction = "true"
355     received message {
356       AMesssage : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ...'
357       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
358     }
359   }
360   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
361 }
362 /**
363 test step instance tsi04: testcase01.ts04oeAddCoordinator{
364   variables {
365     reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
366     AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
367     AdtLogin : testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
368     AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
369   }
370   oracle {
371     satisfaction = "true"
372     received message {
373       tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
374     }
375   }
376   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
377 }
378 /**
379 test step instance tsi05: testcase01.ts05oeLogout{
380   variables {
381     reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
382   }
383   oracle {
384     satisfaction = "true"
385     received message {
386       AMesssage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
387       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
388     }
389   }
390   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
391 }
392 /**
393 test step instance tsi06: testcase01.ts06oeSetClock02{
394   variables {
395     reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
396     ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
397   }
398   oracle {
399     satisfaction = "true"
400   }
401   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
402 }

```

```

403 //-----
404 test step instance tsi07: testcase01.ts07oeAlert1{
405   variables {
406     tango:testcase01.ts07oeAlert1.TheActor ="tango"
407     AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
408     AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
409     AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
410     AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
411     AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
412     AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
413   }
414   oracle {
415     satisfaction = "true"
416     received message {
417       AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and keep you informed'
418       tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
419     }
420   }
421 }
422 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
423 }
424
425 //-----
426 test step instance tsi08: testcase01.ts08oeSetClock03{
427   variables {
428     reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrrentClock
429     ACurrentClock : testcase01.ts08oeSetClock03.ACurrrentClock = "2017:11:26 - 10:30:00"
430   }
431   oracle {
432     satisfaction = "true"
433   }
434   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
435 }
436 //-----
437 test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
438   variables {
439     reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
440     steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
441     reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
442   }
443   oracle {
444     satisfaction = "true"
445     received message {
446       AMesssageForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
447       AMesssageForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please REACT !'
448       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
449         AMesssageForCrisisHandlers)
450       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
451         AMesssageForCrisisHandlers)
452   }
453   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
454 }
455
456 //-----
457 //-----
458 //-----
459 test case instance instance01Part02: testcase01{
460
461 test step instance tsi10: testcase01.ts10oeLogin02{
462   variables {
463     steve : testcase01.ts10oeLogin02.TheActor
464     AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
465     AdtPassword : testcase01.ts10oeLogin02.AdtPassword= "pwdMessirExcalibur2017"
466   }
467   oracle {

```

```

468     satisfaction = "true"
469     received message {
470       AMessage : testcase01.ts10oeLogin02.AMessage= 'You are logged ! Welcome ...'
471       steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
472     }
473   }
474 }
475 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
476 }
477 //-----
478 test step instance ts11: testcase01.ts11oeGetCrisisSet{
479   variables {
480     reuse ts10.steve as testcase01.ts11oeGetCrisisSet.TheActor
481     AdtCrisisStatus : testcase01.ts11oeGetCrisisSet.AdtCrisisStatus = "pending"
482   }
483   oracle {
484     satisfaction = "true"
485     received message {
486       ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
487       ts10.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
488     }
489   }
490   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
491 }
492 //-----
493 test step instance ts12: testcase01.ts12oeSetCrisisHandler{
494   variables {
495     reuse ts10.steve as testcase01.ts12oeSetCrisisHandler.TheActor
496     AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
497     tango : testcase01.ts12oeSetCrisisHandler.TheComCompany
498   }
499   oracle {
500     satisfaction = "true"
501     received message {
502       AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
503       crisis !'
504       AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
505       is in progress !'
506       AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
507
508       tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber, AdtSMS)
509       ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
510     }
511   }
512   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
513 }
514 //-----
515 test step instance ts13: testcase01.ts13oeSetClock04{
516   variables {
517     theClock : testcase01.ts13oeSetClock04.TheActor
518     ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
519   }
520   oracle {
521     satisfaction = "true"
522   }
523   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
524 }
525 //-----
526 test step instance ts14: testcase01.ts14oeValidateAlert{
527   variables {
528     reuse ts10.steve as testcase01.ts14oeValidateAlert.TheActor
529     AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
530   }
531   oracle {
532     satisfaction = "true"
533     received message {
534       AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
535       ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
536   }

```

```

536     }
537   }
538   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
539 }
540 //-----
541 test step instance ts15: testcase01.ts15oeAlert2{
542   variables {
543     reuse ts12.tango as testcase01.ts15oeAlert2.TheActor
544     AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind = "witness"
545     AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
546     AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
547     AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+352466645000"
548     AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
549     AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
550   }
551   message {
552     ts12.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert(
553       AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
554   }
555   oracle {
556     satisfaction = "true"
557     received message {
558       AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
559       keep you informed'
560       ts12.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
561     }
562   }
563   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
564 }
565 //-----
566 test step instance ts16: testcase01.ts16oeSetClock05{
567   variables {
568     reuse ts13.theClock as testcase01.ts16oeSetClock05.TheActor
569     ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
570   }
571   oracle {
572     satisfaction = "true"
573     received message {
574
575     }
576   }
577   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
578 }
579 //-----
580 test step instance ts17: testcase01.ts17oeSetCrisisStatus{
581   variables {
582     reuse ts10.steve as testcase01.ts17oeSetCrisisStatus.TheActor
583     AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
584     AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
585   }
586   oracle {
587     satisfaction = "true"
588     received message {
589       AMesssage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
590       ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
591     }
592   }
593   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
594 }
595 //-----
596 test step instance ts18: testcase01.ts18oeReportOnCrisis{
597   variables {
598     reuse ts10.steve as testcase01.ts18oeReportOnCrisis.TheActor
599     AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
600     AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
601     evacuated and 4 rescue unit mobilized"
602   }
603   oracle {

```

```

603     satisfaction = "true"
604     received message {
605     AMessage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
606     ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
607
608   }
609 }
610   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
611 }
612 //-----
613   test step instance ts19: testcase01.ts19oeCloseCrisis{
614     variables {
615       reuse ts10.steve as testcase01.ts19oeCloseCrisis.TheActor
616       AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
617     }
618     oracle {
619       satisfaction = "true"
620       received message {
621         AMessage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
622
623         ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
624
625       }
626     }
627     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
628   }
629
630 }
631 }
632 }
633 }
```

Listing C.52: Messir Spec. file tci-testcase01-instance01.msr.

C.53 File suDeployAndRun.msr

./src-gen/messir-spec/usecases/usecase-

```

1 package icrash.usecases.suDeployAndRun {
2   import icrash.concepts.primarytypes.datatypes
3   import icrash.environment
4   import icrash.usecases.suGlobalCrisisHandling
5   import icrash.usecases.ugAdministrateTheSystem
6   import icrash.usecases.subfunctions
7
8   Use Case Model {
9     use case system summary suDeployAndRun() {
10    actor actAdministrator[primary,active]
11    actor actMsrCreator[secondary,active]
12    actor actCoordinator[secondary,active,multiple]
13    actor actActivator[secondary,proactive]
14    actor actComCompany[secondary,active]
15
16    reuse oeCreateSystemAndEnvironment[1..1]
17    reuse ugAdministrateTheSystem[1...*]
18    reuse suGlobalCrisisHandling[1...*]
19    reuse oeSetClock[1...*]
20    reuse oeSollicitateCrisisHandling[0...*]
21    reuse oeAlert[1...*]
22
23    step a: actMsrCreator executes oeCreateSystemAndEnvironment
24    step b: actAdministrator executes ugAdministrateTheSystem
25    step c: actComCompany executes oeAlert
26    step d: actActivator executes oeSetClock
27    step ^e: actActivator executes oeSollicitateCrisisHandling
28    step f: actCoordinator executes suGlobalCrisisHandling
29
30   ordering constraint
31   "step (a) must be always the first step."
```

```

32 ordering constraint
33   "step (f) can be executed by different actCoordinator actors."
34 ordering constraint
35   "if (e) then previously (d)."
36 }
37 //-----
38 //-----
39 //-
40 use case instance uciSimpleAndComplete : suDeployAndRun {
41   actors {
42     theCreator : actMsrCreator
43     theClock : actActivator
44     bill : actAdministrator
45     tango : actComCompany
46     steve : actCoordinator
47   }
48   use case steps {
49 //-
50   theCreator
51     executed instanceof subfunction
52       oeCreateSystemAndEnvironment("4"){}
53 //-
54   theClock
55     executed instanceof subfunction
56       oeSetClock("2017:11:24 - 03:20:00"){}
57 //-
58   bill
59     executed instanceof subfunction
60       oeLogin("icrashadmin","7WXC1359"){
61         ieMessage('You login and password are correct. Sms code has been sent') returned to bill
62       }
63 //-
64   bill
65     executed instanceof subfunction
66       oesMS("456123"){
67         ieMessage('You are logged in ! Wellcome ...') returned to bill
68       }
69 //-
70   bill
71     executed instanceof subfunction
72       oeAddCoordinator("1","steve","pwdMessirExcalibur2017","8933123434","southWestern","high"){
73         ieCoordinatorAddedreturned returned to bill
74       }
75 //-
76   bill
77     executed instanceof subfunction
78       oeLogout{
79         ieMessage('You are logged out ! Good Bye ...') returned to bill
80       }
81 //-
82   theClock
83     executed instanceof subfunction
84       oeSetClock("2017:11:26 - 10:15:00"){}
85 //-
86   tango
87     executed instanceof subfunction
88       oeAlert("witness","2017:11:26","10:10:16","+3524666445252",
89         "49.627675:6.159590","3 cars involved in an accident.", "high"){
90         ieSmsSend("+3524666445252","Your alert has been registered. We will handle it and keep you
informed") returned to tango
91       }
92 //-
93   theClock
94     executed instanceof subfunction
95       oeSetClock("2017:11:26 - 10:30:00"){}
96 //-
97   theClock
98     executed instanceof subfunction
99       oeSollicitateCrisisHandling(
100         ieMessage("There are alerts pending since more than the defined delay. Please REACT !"))

```

```

101      returned to bill
102      ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
103      returned to steve
104  }
105 //-
106  steve
107  executed instanceof subfunction
108  oeLogin("steve", "pwdMessirExcalibur2017") {
109      ieMessage('Your login and password are correct. Sms code has been sent') returned to steve
110  }
111 //-
112  steve
113  executed instanceof subfunction
114  oeSMS("241312") {
115      ieMessage('Your are logged in ! Wellcome ...') returned to steve
116  }
117 //-
118  steve
119  executed instanceof subfunction
120  oeGetCrisisSet("pending") {
121      ieSendACrisis("crisis with ID 1 details") returned to steve
122  }
123 //-
124  steve
125  executed instanceof subfunction
126  oeSetCrisisHandler("1") {
127      ieSmsSend("+3524666445252", "The handling of your alert by our services is in progress !")
128      returned to tango
129      ieMessage("You are now considered as handling the crisis !")
130      returned to steve
131  }
132 //-
133  theClock
134  executed instanceof subfunction
135  oeSetClock("2017:11:26 - 10:45:00") {}
136 //-
137  steve
138  executed instanceof subfunction
139  oeValidateAlert("1") {
140      ieMessage('The Alert is now declared as valid !')
141      returned to steve
142  }
143 //-
144  tango
145  executed instanceof subfunction
146  oeAlert("witness", "2017:11:26", "10:20:00", "+3524666445000",
147      "49.627095:6.160251", "A car crash just happened.", "medium") {
148      ieSmsSend("+3524666445000", "Your alert has been registered. We will handle it and keep you
informed") returned to tango
149  }
150 //-
151  tango
152  executed instanceof subfunction
153  oeAlert("witness", "2017:11:26", "10:20:00", "+3524666445112",
154      "69.33143:65.160251", "A car hit 2 pedestrians.", "high") {
155      ieSmsSend("+3524666445112", "Your alert has been registered. We will handle it and keep you
informed") returned to tango
156  }
157 //-
158  theClock
159  executed instanceof subfunction
160  oeSetClock("2017:11:26 - 12:45:00") {}
161 //-
162  steve
163  executed instanceof subfunction
164  oeSetCrisisStatus("1", "solved") {
165      ieMessage('The crisis status has been updated !')
166      returned to steve
167  }
168 //-

```

```

169    steve
170    executed instanceof subfunction
171        oeReportOnCrisis("1","3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
mobilized")
172            ieMessage('The crisis comment has been updated !')
173            returned to steve
174        }
175    //-----
176    steve
177    executed instanceof subfunction
178        oeCloseCrisis("1"){
179            ieMessage('The crisis is now closed !')
180            returned to steve
181        }
182    steve
183    executed instanceof subfunction
184        oeGetCrisisSet("pending"){
185            //ieSendACrisis("crisis with ID 1 details") returned to steve
186        }
187    }
188 }
189 //-----
190 //-----
191 //-----
192 //-----
193 use case instance uciSimpleAndCompletePart01 : suDeployAndRun{
194
195    actors {
196        theCreator : actMsrCreator
197        theClock : actActivator
198        bill : actAdministrator
199        tango : actComCompany
200        steve : actCoordinator
201    }
202    use case steps {
203    //-----
204        theCreator
205        executed instanceof subfunction
206            oeCreateSystemAndEnvironment("4"){}
207    //-----
208        theClock
209        executed instanceof subfunction
210            oeSetClock("2017:11:24 - 03:20:00"){}
211    //-----
212        bill
213        executed instanceof subfunction
214            oeLogin("icrashadmin","7WXC1359"){
215                ieMessage('You login and password are correct. Sms code has been sent') returned to bill
216            }
217    //-----
218        bill
219        executed instanceof subfunction
220            oesMS("456123"){
221                ieMessage('You are logged in ! Wellcome ...') returned to bill
222            }
223    //-----
224        bill
225        executed instanceof subfunction
226            oeAddCoordinator("1","steve","pwdMessirExcalibur2017","8933123434","southWestern","high"){
227                ieCoordinatorAddedreturned returned to bill
228            }
229    //-----
230        bill
231        executed instanceof subfunction
232            oeLogout{
233                ieMessage('You are logged out ! Good Bye ...') returned to bill
234            }
235    //-----
236        theClock
237        executed instanceof subfunction

```

```

238     oeSetClock("2017:11:26 - 10:15:00") {}
239 //-----
240     tango
241     executed instanceof subfunction
242         oeAlert("witness","2017:11:26","10:10:16","+3524666445252",
243             "49.627675:6.159590","3 cars involved in an accident.", "high")
244         ieSmsSend("+3524666445252","Your alert has been registered. We will handle it and keep you
245         informed") returned to tango
246 }
247 //-----
248     theClock
249     executed instanceof subfunction
250         oeSetClock("2017:11:26 - 10:30:00") {}
251 //-----
252     theClock
253     executed instanceof subfunction
254         oeSollicitateCrisisHandling{
255             ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
256             returned to bill
257             ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
258             returned to steve
259         }
260     }
261 //-----
262 //-----
263 //-----
264     use case instance uciSimpleAndCompletePart02 : suDeployAndRun{
265         actors {
266             theCreator : actMsrCreator
267             theClock : actActivator
268             bill : actAdministrator
269             tango : actComCompany
270             steve : actCoordinator
271         }
272         use case steps {
273
274 //-----
275             steve
276             executed instanceof subfunction
277                 oeLogin("steve", "pwdMessirExcalibur2017"){
278                     ieMessage('Your login and password are correct. Sms code has been sent') returned to steve
279                 }
280 //-----
281             steve
282             executed instanceof subfunction
283                 oeSMS("241312"){
284                     ieMessage('Your are logged in ! Wellcome ...') returned to steve
285                 }
286 //-----
287             steve
288             executed instanceof subfunction
289                 oeGetCrisisSet("pending"){
290                     ieSendACrisis("crisis with ID 1 details") returned to steve
291                 }
292 //-----
293             steve
294             executed instanceof subfunction
295                 oeSetCrisisHandler("1"){
296                     ieSmsSend("+3524666445252","The handling of your alert by our services is in progress !")
297                     returned to tango
298                     ieMessage("You are now considered as handling the crisis !")
299                     returned to steve
300                 }
301 //-----
302             theClock
303             executed instanceof subfunction
304                 oeSetClock("2017:11:26 - 10:45:00") {}
305 //-----
306             steve

```

```

307  executed instanceof subfunction
308      oeValidateAlert("1"){
309          ieMessage('The Alert is now declared as valid !')
310          returned to steve
311      }
312 //-----
313  tango
314  executed instanceof subfunction
315      oeAlert("witness","2017:11:26","10:20:00","+3524666445000",
316          "49.627095:6.160251","A car crash just happened.", "medium") {
317          ieSmsSend("+3524666445000","Your alert has been registered. We will handle it and keep you
informed") returned to tango
318      }
319
320 //-----
321  tango
322  executed instanceof subfunction
323      oeAlert("witness","2017:11:26","10:20:00","+3524666445112",
324          "69.33143:65.160251","A car hit 2 pedestrians.", "high") {
325          ieSmsSend("+3524666445112","Your alert has been registered. We will handle it and keep you
informed") returned to tango
326      }
327 //-----
328  theClock
329  executed instanceof subfunction
330      oeSetClock("2017:11:26 - 12:45:00") {}
331 //-----
332  steve
333  executed instanceof subfunction
334      oeSetCrisisStatus("1", "solved") {
335          ieMessage('The crisis status has been updated !')
336          returned to steve
337      }
338 //-----
339  steve
340  executed instanceof subfunction
341      oeReportOnCrisis("1", "3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
mobilized") {
342          ieMessage('The crisis comment has been updated !')
343          returned to steve
344      }
345 //-----
346  steve
347  executed instanceof subfunction
348      oeCloseCrisis("1") {
349          ieMessage('The crisis is now closed !')
350          returned to steve
351      }
352  steve
353  executed instanceof subfunction
354      oeGetCrisisSet("pending") {
355          //ieSendACrisis("crisis with ID 1 details") returned to steve
356      }
357
358  }
359 }
360 use case instance uciSimpleAndCompletePart03 : suDeployAndRun{
361 actors {
362     theCreator : actMsrCreator
363     theClock : actActivator
364     bill : actAdministrator
365     tango : actComCompany
366     steve : actCoordinator
367 }
368 use case steps {
369
370 //-----
371  steve
372  executed instanceof subfunction
373      oeLogin("steve", "pwdMessirExcalibur2017") {

```

```

374     ieMessage('Your login and password are correct. Sms code has been sent') returned to steve
375   }
376
377   }
378   }
379 }
380 }
```

Listing C.53: Messir Spec. file usecase-suDeployAndRun.msr.

C.54 File [./src-gen/messir-spec/usecases/usecase-suGlobalCrisisHandling.msr](#)

```

1 package icrash.usecases.suGlobalCrisisHandling {
2   import lu.uni.lassy.messir.libraries.primitives
3   import icrash.environment
4   import icrash.usecases.subfunctions
5   import icrash.usecases.ugSecurelyUseSystem
6   import icrash.usecases.ugManageCrisis
7   import icrash.usecases.ugMonitor
8
9   Use Case Model {
10    use case system summary
11    suGlobalCrisisHandling() {
12      actor actCoordinator[primary, active]
13
14      reuse ugSecurelyUseSystem[1...*]
15      reuse ugMonitor[1...*]
16      reuse ugManageCrisis[1...*]
17
18      step a: actCoordinator
19        executes ugSecurelyUseSystem
20      step b: actCoordinator
21        executes ugMonitor
22      step c: actCoordinator
23        executes ugManageCrisis
24
25      ordering constraint
26      "steps (a) (b) and (c) executions are interleaved
27      (steps (b) and (c) have their protocol constrained by steps of (a))."
28      ordering constraint
29      "steps (a) (b) and (c) can be executed multiple times."
30    }
31  }
```

Listing C.54: Messir Spec. file usecase-suGlobalCrisisHandling.msr.

C.55 File [./src-gen/messir-spec/usecases/usecase-ugAdministrateTheSystem.msr](#)

```

1 package icrash.usecases.ugAdministrateTheSystem {
2
3   import icrash.environment
4   import icrash.usecases.ugSecurelyUseSystem
5   import icrash.usecases.subfunctions
6
7   Use Case Model {
8
9    use case system usergoal
10   ugAdministrateTheSystem() {
11     actor actAdministrator[primary, active]
12
13     reuse ugSecurelyUseSystem[1...*]
14     reuse oeAddCoordinator[1...*]
15     reuse oeDeleteCoordinator[0...*]
16     reuse oeEditCoordinator[0...*]
```

```

17
18   step a: actAdministrator
19     executes ugSecurelyUseSystem
20   step b: actAdministrator
21     executes oeAddCoordinator
22   step c: actAdministrator
23     executes oeDeleteCoordinator
24   step d: actAdministrator
25     executes oeEditCoordinator
26   ordering constraint
27     "steps (a) (b) (c) and (d) executions are interleaved
28     (steps (b) and (c) have their protocol constrained
29     by steps of (a))."
30   ordering constraint
31     "steps (a) (b) (c) and (d) can be executed multiple times."
32 }
33 }
34 }
```

Listing C.55: Messir Spec. file usecase-ugAdministateTheSystem.msr.

C.56 File ./src-gen/messir-spec/usecases/usecase-ugManageCrisis.msr

```

1 package icrash.usecases.ugManageCrisis {
2
3 import icrash.environment
4 import icrash.usecases.subfunctions
5
6 Use Case Model {
7
8   use case system usergoal ugManageCrisis() {
9     actor actCoordinator[primary, active]
10
11   reuse oeValidateAlert[0...*]
12   reuse oeSetCrisisStatus[0...*]
13   reuse oeSetCrisisHandler[0...*]
14   reuse oeReportOnCrisis[0...*]
15   reuse oeCloseCrisis[0...*]
16   reuse oeInvalidateAlert[0...*]
17   reuse oeSetCrisisType[0...*]
18
19   step a: actCoordinator executes oeValidateAlert
20   step b: actCoordinator executes oeSetCrisisStatus
21   step c: actCoordinator executes oeSetCrisisHandler
22   step d: actCoordinator executes oeReportOnCrisis
23   step f: actCoordinator executes oeCloseCrisis
24   step g: actCoordinator executes oeInvalidateAlert
25   step h: actCoordinator executes oeSetCrisisType
26
27   ordering constraint "managing a crisis is doing one of the indicated use cases."
28
29 }
30
31 }
32 }
```

Listing C.56: Messir Spec. file usecase-ugManageCrisis.msr.

C.57 File ./src-gen/messir-spec/usecases/usecase-ugMonitor.msr

```

1 package icrash.usecases.ugMonitor {
2
3 import icrash.environment
4 import icrash.usecases.subfunctions
5
6 Use Case Model {
```

```

7  use case system usergoal ugMonitor() {
8    actor icrash.environment.actCoordinator[primary,active]
9
10   reuse oeGetCrisisSet[0..*]
11   reuse oeGetAlertsSet[0..*]
12
13   step a: icrash.environment.actCoordinator executes oeGetAlertsSet
14   step b: icrash.environment.actCoordinator executes oeGetCrisisSet
15 }
16 }
17 }
```

Listing C.57: Messir Spec. file usecase-ugMonitor.msr.

C.58 File [./src-gen/messir-spec/usecases/usecase-ugSecurelyUseSystem.msr](#)

```

1 package icrash.usecases.ugSecurelyUseSystem {
2
3 import icrash.environment
4 import icrash.usecases.subfunctions
5
6 Use Case Model {
7
8 use case system usergoal
9 ugSecurelyUseSystem() {
10
11   actor actAuthenticated[primary,active]
12
13   reuse oeLogin[1..1]
14   reuse oeLogout[1..1]
15   reuse oeSMS[1..1]
16
17   step a: actAuthenticated
18     executes oeLogin
19   step b: actAuthenticated
20     executes oeLogout
21   step c: actAuthenticated
22     executes oeSMS
23
24 ordering constraint
25   "step (a) must always precede step (c). step (c) must always precede step(b). "
26 }
27 }
28 }
```

Listing C.58: Messir Spec. file usecase-ugSecurelyUseSystem.msr.

C.59 File [./src-gen/messir-spec/usecases/usecaseinstance-ugSecurelyUseSystem-uciugSecurelyUseSystem.msr](#)

```

1 package usecases.uciugSecurelyUseSystem {
2 import icrash.usecases.ugSecurelyUseSystem
3 import icrash.usecases.ugSecurelyUseSystem
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.environment
6 import icrash.usecases.suGlobalCrisisHandling
7 import icrash.usecases.ugAdministateTheSystem
8 import icrash.usecases.subfunctions
9
10 Use Case Model {
11
12 //-----
13 use case instance uciugSecurelyUseSystem : ugSecurelyUseSystem {
14   actors {
15     bill:actAuthenticated
```

```

16    }
17    use case steps {
18 //-----
19    bill
20    executed instanceof subfunction
21      oeLogin("icrashadmin","7WXC1359"){
22        ieMessage('You login and password are correct. Sms code has been sent') returned to bill
23      }
24 //-----
25    bill
26    executed instanceof subfunction
27      oesSMS("456123"){
28        ieMessage('You are logged in ! Wellcome ...') returned to bill
29      }
30 //-----
31    bill
32    executed instanceof subfunction
33      oeLogout{
34        ieMessage('You are logged out ! Good Bye ...') returned to bill
35      }
36  }
37 }
38 }
39 }

```

Listing C.59: Messir Spec. file usecaseinstance-ugSecurelyUseSystem-uciugSecurelyUseSystem.msr.

Appendix D

Listing of the Prolog Files Referenced in the Operation Model Specification

D.1

File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactActivatorSetClock.pl

```
1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactActivator,
7    oeSetClock,
8    [preProtocol,Self,
9     AcurrentClock
10    ],
11    []):-!
12/* Pre Protocol:*/
13/* PreP01 */
14 msrVar(ctState,TheSystem),
15 msrVar(ptBoolean,AvpStarted),
16
17 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
18
19 msrNav([Self],[rnActor,rnSystem,vpStarted],[AvpStarted]),
20 AvpStarted = [ptBoolean,true],
21
22 msrNav([TheSystem],
23     [clock,lt,[AcurrentClock]],
24     [[ptBoolean,true]]))
25 .
26
27msrop(outactActivator,
28    oeSetClock,
29    [preFunctional,Self,
30     AcurrentClock
31    ],
32    []):-!
33/* Pre Functional:*/
34/* PreF01 */
35true.
36
37msrop(outactActivator,
38    oeSetClock,
39    [post,Self,
40     AcurrentClock
41    ],
42    []):-!
```

```

44 msrVar(ctState,TheSystem),
45
46 /* Post Functional:*/
47
48 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
49
50 /* PostF01 */
51 msrNav([TheSystem],
52     [msmAtPost,clock],
53     [AcurrentClock]),
54
55 /* Post Protocol:*/
56 /* PostP01 */
57 true
58 .

```

Listing D.1: Prolog file outactActivator-oeSetClock.pl.

D.2 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactActivator-oeSollicitateCrisisHandling.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6
7msrop(outactActivator,
8    oeSollicitateCrisisHandling,
9    [preProtocol,Self
10   ],
11   []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
15
16 msrVarCol(ctCrisis,_,ColctCrisisToHandle),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23/* PreP02 */
24 msrNav([TheSystem],
25     [rnctCrisis,msrSelect,
26      handlingDelayPassed,[]]
27   ],
28   ColctCrisisToHandle),
29
30 msrNav(ColctCrisisToHandle,
31     [msrSize,geq,[[ptInteger,1]]],
32     [[ptBoolean,true]]),
33.
34
35msrop(outactActivator,
36    oeSollicitateCrisisHandling,
37    [preFunctional,Self
38   ],
39   []):-!
40/* Pre Functional:*/
41/* PreF01 */
42true.
43
44msrop(outactActivator,
45    oeSollicitateCrisisHandling,
46    [post,Self
47   ],

```

```

48      []):-  

49  

50 msrVar(ctState,TheSystem),  

51 msrVar(dtComment,AMessageForCrisisHandlers),  

52 msrVar(dtDateAndTime, TheClock),  

53 msrVarCol(ctCrisis,_,ColctCrisisToAllocateIfPossible),  

54  

55/* Post Functional:*/  

56 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

57  

58 /* PostF01 */  

59 msrNav([TheSystem],  

60     [rnctCrisis,msrSelect,  

61      maxHandlingDelayPassed, []  

62     ],  

63     ColctCrisisToAllocateIfPossible),  

64  

65msrNav(ColctCrisisToAllocateIfPossible,  

66     [msrForAll,isAllocatedIfPossible,[],  

67     [[ptBoolean,true]]],  

68  

69 /* PostF02 */  

70 msrNav([TheSystem],  

71     [rnctCrisis,msrSelect,  

72      handlingDelayPassed, []  

73     ],  

74     ColctCrisisToHandle),  

75  

76 msrNav(ColctCrisisToHandle,  

77     [msrColSubtract,[ColctCrisisToAllocateIfPossible]  

78     ],  

79     ColctCrisisToRemind),  

80  

81 (msrNav(ColctCrisisToRemind,  

82     [msrSize,geq,[[ptInteger,1]]],  

83     [[ptBoolean,true]])  

84 -> (msrNav([AMessageForCrisisHandlers],  

85     [value],  

86     [[ptString,'There are alerts pending since more than the defined delay. Please REACT !']] ),  

87  

88 msrNav([TheSystem],  

89     [rnactAdministrator,rnInterfaceIN,  

90      ieMessage, [AMessageForCrisisHandlers]  

91     ],  

92     [[ptBoolean,true]]),  

93  

94 msrNav([TheSystem],  

95     [rnactCoordinator,msrForAll,rnInterfaceIN,  

96      ieMessage, [AMessageForCrisisHandlers]  

97     ],  

98     [[ptBoolean,true]]))  

99 )  

100 ; true  

101 ),  

102  

103/* Post Protocol:*/  

104/* PostP01 */  

105 msrNav([TheSystem],  

106     [clock],  

107     [TheClock]),  

108  

109 msrNav([TheSystem],  

110     [msmAtPost,vpLastReminder],  

111     [TheClock])  

112 .

```

Listing D.2: Prolog file outactActivator-oeSollicitateCrisisHandling.pl.

D.3 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAdm oeAddCoordinator.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%-----%
6msrop(outactAdministrator,
7    oeAddCoordinator,
8    [preProtocol,Self,
9     AdtCoordinatorID,
10    AdtLogin,
11    AdtPassword
12    ],
13    []):-!
14/* Pre Protocol:*/
15 msrVar(ctState,TheSystem),
16 msrVar(actAdministrator,TheActor),
17 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
18 msrNav([Self],[rnActor],[TheActor]),
19 .
20/* PreP01 */
21 msrNav([TheSystem],
22     [vpStarted],
23     [[ptBoolean,true]]),
24 .
25/* PreP02 */
26 msrNav([TheActor],
27     [rnctAuthenticated,vpIsLogged],
28     [[ptBoolean,true]]),
29 .
30 .
31 .
32msrop(outactAdministrator,
33    oeAddCoordinator,
34    [preFunctional,Self,
35     AdtCoordinatorID,
36     AdtLogin,
37     AdtPassword
38    ],
39    []):-!
40/* Pre Functional:*/
41 msrVar(ctState,TheSystem),
42 msrVar(actAdministrator,TheActor),
43 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
44 msrNav([Self],[rnActor],[TheActor]),
45/* PreF01 */
46 msrNav([TheSystem],
47     [rnctCoordinator,
48      msrSelect,id,eq,[AdtCoordinatorID]],
49     ColctCoordinators),
50 msrNav(ColctCoordinators,
51     [msrIsEmpty],
52     [[ptBoolean,true]]),
53 .
54 .
55msrop(outactAdministrator,
56    oeAddCoordinator,
57    [post,Self,
58     AdtCoordinatorID,
59     AdtLogin,
60     AdtPassword
61    ],
62    []):-!
63 .
64/* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actAdministrator,TheActor),

```

```

67 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
68 msrNav([Self],[rnActor],[TheActor]),
69
70 msrVar(actCoordinator,TheactCoordinator),
71 msrVar(ctCoordinator,ThectCoordinator),
72
73 /* PostF01 */
74 msrNav([TheactCoordinator],
75     [init,[]],
76     [[ptBoolean,true]]),
77
78 /* PostF02 */
79 msrNav([ThectCoordinator],
80     [init,[AdtCoordinatorID,AdtLogin,AdtPassword]],
81     [[ptBoolean,true]]),
82
83 /* PostF03 */
84 msrNav([TheactCoordinator],
85     [msmAtPost,rnctCoordinator],
86     [ThectCoordinator]),
87
88 /* PostF04 */
89 msrNav([ThectCoordinator],
90     [msmAtPost,rnactAuthenticated],
91     [TheactCoordinator]),
92
93 /* PostF05 */
94 msrNav([TheActor],
95     [rnInterfaceIN,
96     ieCoordinatorAdded,[]],
97     [[ptBoolean,true]]),
98
99 /* Post Protocol:*/
100 /* PostP01 */
101 true
102 .

```

Listing D.3: Prolog file outactAdministrator-oeAddCoordinator.pl.

D.4 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAdministrator-oeDeleteCoordinator.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactAdministrator,
7    oeDeleteCoordinator,
8    [preProtocol,Self,
9     AdtCoordinatorID
10    ],
11    []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actAdministrator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]]))
26.

```

```

27
28msrop(outactAdministrator,
29    oeDeleteCoordinator,
30    [preFunctional,Self,
31     AdtCoordinatorID
32    ],
33    []):-!
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actAdministrator,TheActor),
37 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
38 msrNav([Self],[rnActor],[TheActor]),
39
40/* PreF01 */
41 msrNav([TheSystem],
42     [rnctCoordinator,
43      msrSelect,id,eq,[AdtCoordinatorID]],
44     ColctCoordinators),
45
46 msrNav(ColctCoordinators,
47     [msrSize,eq,[[ptInteger,1]]],
48     [[ptBoolean,true]]).
49
50msrop(outactAdministrator,
51    oeDeleteCoordinator,
52    [post,Self,
53     AdtCoordinatorID
54    ],
55    []):-!
56
57/* Post Functional:*/
58 msrVar(ctState,TheSystem),
59 msrVar(actAdministrator,TheActor),
60 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
61 msrNav([Self],[rnActor],[TheActor]),
62
63/* PostF01 */
64 msrNav([TheSystem],
65     [rnctCoordinator,
66      msrSelect,id,eq,[AdtCoordinatorID]],
67     [ThectCoordinator]),
68
69 msrNav([ThectCoordinator],
70     [rnactCoordinator,msrForAll,msrIsKilled],
71     [[ptBoolean,true]]),
72
73 msrNav([ThectCoordinator],
74     [msrIsKilled],
75     [[ptBoolean,true]]),
76
77 /* PostF02 */
78 msrNav([TheActor],
79     [rnInterfaceIN,
80      ieCoordinatorDeleted,[]]
81    ],
82    [[ptBoolean,true]]),
83
84 /* Post Protocol:*/
85/* PostP01 */
86 true
87 .

```

Listing D.4: Prolog file outactAdministrator-oeDeleteCoordinator.pl.

D.5 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAdministrator-oeLogin.pl

%%%%%%%%%%%%%

```

2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%-----%
6msrop(outactAuthenticated,
7    oeLogin,
8    [preProtocol,Self,
9     AdtLogin,
10    AdtPassword
11    ],
12    []):-.
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actAuthenticated,TheactAuthenticated),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheactAuthenticated]),
18 .
19 /* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23 .
24 msrNav([TheactAuthenticated],
25     [rnctAuthenticated,vpisLogged],
26     [[ptBoolean,false]])
27 .
28
29msrop(outactAuthenticated,
30    oeLogin,
31    [preFunctional,Self,
32     AdtLogin,
33     AdtPassword
34     ],
35    []):-.
36/* Pre Functional:*/
37/* PreF01 */
38true
39.
40
41msrop(outactAuthenticated,
42    oeLogin,
43    [post,Self,
44     AdtLogin,
45     AdtPassword
46     ],
47    []):-.
48
49 msrVar(ctState,TheSystem),
50 msrVar(actAuthenticated,TheactAuthenticated),
51 .
52 msrVar(ptString,AptStringMessageForTheactAuthenticated),
53 msrVar(ptString,AptStringMessageForTheactAdministrator),
54 .
55/* Post Functional:*/
56
57 msrNav([Self],[rnActor],[TheactAuthenticated]),
58 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
59 .
60/* PostF01 */
61
62 ( (msrNav([TheactAuthenticated],
63            [rnctAuthenticated,pwd],
64            [AdtPassword]),
65   msrNav([TheactAuthenticated],
66            [rnctAuthenticated,login],
67            [AdtLogin])
68 )
69 -> ( msrNav([AptStringMessageForTheactAuthenticated],
70              [eq,[[ptString,'You are logged ! Welcome ...']]],
71              [[ptBoolean,true]]),

```

```

72     msrNav([TheactAuthenticated],
73         [rnInterfaceIN,
74          ieMessage, [AptStringMessageForTheactAuthenticated]],
75          [[ptBoolean,true]])
76    )
77 ; ( msrNav([AptStringMessageForTheactAuthenticated],
78         [eq,[[ptString,'Wrong identification information ! Please try again ...']]],,
79         [[ptBoolean,true]]),
80     msrNav([TheactAuthenticated],
81         [rnInterfaceIN,
82          ieMessage, [AptStringMessageForTheactAuthenticated]],
83          [[ptBoolean,true]]),
84
85     msrNav([AptStringMessageForTheactAdministrator],
86         [eq,[[ptString,'Intrusion tentative !']]],,
87         [[ptBoolean,true]]),
88     msrNav([TheSystem],
89         [rnactAdministrator,rnInterfaceIN,
90          ieMessage, [AptStringMessageForTheactAdministrator]],
91          [[ptBoolean,true]])
92    )
93 ),
94
95 /* Post Protocol:*/
96/* PostP01 */
97 ( (msrNav([TheactAuthenticated],
98     [rnctAuthenticated,pwd],
99     [AdtPassword]),
100 msrNav([TheactAuthenticated],
101     [rnctAuthenticated,login],
102     [AdtLogin])
103 )
104 -> (msrNav([TheactAuthenticated],
105     [rnctAuthenticated,msmAtPost,vpIsLogged],
106     [[ptBoolean,true]])
107   )
108 ; true
109 )
110 .

```

Listing D.5: Prolog file outactAuthenticated-oeLogin.pl.

D.6 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAuthenticated-oeLogout.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactAuthenticated,
7    oeLogout,
8    [preProtocol,Self
9     ],
10    []):- 
11/* Pre Protocol:*/
12 msrVar(ctState,TheSystem),
13 msrVar(actAuthenticated,TheActor),
14 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
15 msrNav([Self],[rnActor],[TheActor]),
16
17/* PreP01 */
18 msrNav([TheSystem],
19     [vpStarted],
20     [[ptBoolean,true]]),
21
22 msrNav([TheActor],
23     [rnctAuthenticated,vpIsLogged],

```

```

24     [[ptBoolean,true]]) )
25 .
26
27msrop(outactAuthenticated,
28     oeLogout,
29     [preFunctional,Self
30     ],
31     []):- 
32/* Pre Functional:*/
33/* PreF01 */
34true
35.
36
37msrop(outactAuthenticated,
38     oeLogout,
39     [post,Self
40     ],
41     []):- 
42
43 msrVar(ctState,TheSystem),
44 msrVar(actAuthenticated,TheactAuthenticated),
45
46 msrVar(ptString,AptStringMessageForTheactAuthenticated),
47
48/* Post Functional:*/
49 msrNav([Self],[rnActor],[TheactAuthenticated]),
50 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
51
52/* PostF01 */
53 msrNav([AptStringMessageForTheactAuthenticated],
54     [eq,[[ptString,'You are logged out ! Good Bye ...']]], 
55     [[ptBoolean,true]]),
56 msrNav([TheactAuthenticated],
57     [rnInterfaceIN,
58      ieMessage,[AptStringMessageForTheactAuthenticated]],
59     [[ptBoolean,true]]),
60
61 /* Post Protocol:*/
62/* PostP01 */
63msrNav([TheactAuthenticated],
64     [rnctAuthenticated,msmAtPost,vpIsLogged],
65     [[ptBoolean,false]])
66.

```

Listing D.6: Prolog file outactAuthenticated-oeLogout.pl.

D.7 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactComCoeAlert.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6nico(A):-
7 trace,
8 write('here'),
9 write('\n').
10
11msrop(outactComCompany,
12     oeAlert,
13     [preProtocol,Self,
14      AetHumanKind,
15      AdtDate,
16      AdtTime,
17      AdtPhoneNumber,
18      AdtGPSLocation,
19      AdtComment

```

```

20      ],
21      []):-  

22 /* Pre Protocol:-/  

23 msrVar(ctState,TheSystem),  

24 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

25 /* PreP01 */  

26 msrNav([TheSystem],  

27     [vpStarted],  

28     [[ptBoolean,true]]))  

29 .  

30  

31 msrop(outactComCompany,  

32     oeAlert,  

33     [preFunctional,Self,  

34     AetHumanKind,  

35     AdtDate,  

36     AdtTime,  

37     AdtPhoneNumber,  

38     AdtGPSLocation,  

39     AdtComment  

40     ],  

41     []):-  

42 /* Pre Functional:-/  

43 /* PreF01 */  

44 msrVar(ctState,TheSystem),  

45 msrNav([Self],  

46     [msmAtPre,rnActor,rnSystem],  

47     [TheSystem]),  

48  

49 ( msrNav([TheSystem],[clock,date,gt,[AdtDate]],[[ptBoolean,true]]))  

50 ; (msrNav([TheSystem],[clock,date,eq,[AdtDate]],[[ptBoolean,true]]))  

51 , msrNav([TheSystem],[clock,time,gt,[AdtTime]],[[ptBoolean,true]]))  

52 )  

53 )  

54 .  

55  

56 msrop(outactComCompany,  

57     oeAlert,  

58     [post,Self,  

59     AetHumanKind,  

60     AdtDate,  

61     AdtTime,  

62     AdtPhoneNumber,  

63     AdtGPSLocation,  

64     AdtComment  

65     ],  

66     []):-  

67  

68 msrVar(ctState,TheSystem),  

69 msrVar(ctHuman,ActHuman),  

70 msrVar(actComCompany,TheactComCompany),  

71 msrVar(ctAlert,ActAlert),  

72 msrVar(dtDateAndTime,AAlertInstant),  

73 msrVar(etAlertStatus,AetAlertStatus),  

74% msrVar(ctAlert,ActAlertNearBy),  

75 msrVar(ctCrisis,ActCrisis),  

76 msrVar(dtCrisisID,AdtCrisisID),  

77% msrVar(etCrisisType,AetCrisisType),  

78 msrVar(etCrisisStatus,AetCrisisStatus),  

79 msrVar(dtDateAndTime,ACrisisInstant),  

80 msrVar(dtComment,ACrisisdtComment),  

81% msrVar(ptString,AptStringMessage),  

82 msrVar(dtSMS,AdtSMS),  

83 msrVar(dtAlertID,AdtAlertID),  

84  

85% msrVar(ptInteger,TheNextptIntegerValue),  

86% msrVar(ptInteger,UpdatedNextptIntegerValue),  

87% msrVar(inactComCompany,TheComCompanyIN),  

88% msrVar(dtComment,TheCommentStored),  

89% msrVar(dtString,TheCommentStoreddtString),

```

```

90
91/* Post Functional:*/
92
93 msrNav([Self], [rnActor], [TheactComCompany]),
94 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
95
96/* PostF01 */
97 msrNav([TheSystem],
98     [nextValueForAlertID],
99     [PrenextValueForAlertID]),
100 msrNav([PrenextValueForAlertID],
101     [add, [[dtInteger, [[value, [ptInteger, 1]]], []]], [PostnextValueForAlertID]),
102     [PostnextValueForAlertID]),
103 msrNav([TheSystem],
104     [msmAtPost, nextValueForAlertID],
105     [PostnextValueForAlertID]),
106
107 /* PostF02 */
108 msrNav([AAlerInstant], [date], [AdtDate]),
109 msrNav([AAlerInstant], [time], [AdtTime]),
110
111 msrNav([AetAlertStatus],
112     []),
113     [[etAlertStatus, pending]]),
114
115 msrNav([TheSystem],
116     [nextValueForAlertID,
117     todTimeString, [], eq, [AdtAlertID]],
118     [[ptBoolean, true]]),
119
120 msrNav([ActAlert],
121     [init, [AdtAlertID,
122             AetAlertStatus,
123             AdtGPSLocation,
124             AAlerInstant,
125             AdtComment]],,
126     [[ptBoolean, true]]),
127
128 /* PostF03 */
129 msrNav([TheSystem],
130     [rnctAlert,
131     msrSelect, location, isNearTo, [AdtGPSLocation]],
132     ColctAlertsNearBy),
133
134 ( (msrNav(ColctAlertsNearBy,
135     [msrIsEmpty],
136     [[ptBoolean, true]]))
137 )
138 -> (
139     msrNav([TheSystem],
140         [nextValueForCrisisID,
141         [PrenextValueForCrisisID]],
142         msrNav([PrenextValueForCrisisID],
143             [add, [[dtInteger, [[value, [ptInteger, 1]]], []]], [PostnextValueForCrisisID]),
144             [PostnextValueForCrisisID]),
145         msrNav([TheSystem],
146             [msmAtPost, nextValueForCrisisID],
147             [PostnextValueForCrisisID]),
148
149         msrNav([TheSystem],
150             [nextValueForCrisisID,
151             todTimeString, [], eq, [AdtCrisisID]],
152             [[ptBoolean, true]]),
153
154         msrNav([AdtCrisisType], [], [[etCrisisType, small]]),
155         msrNav([AetCrisisStatus], [], [[etCrisisStatus, pending]]),
156         msrNav([ACrisisInstant], [], [AAlerInstant]),
157         msrNav([ACrisisdtComment],
158             [value],
159             [[ptString, 'no reporting yet defined']])),

```

```

160   msrNav([ActCrisis],[init,[AdtCrisisID,
161             AdtCrisisType,
162             AetCrisisStatus,
163             AdtGPSLocation,
164             ACrisisInstant,
165             ACrisisdtComment]],,
166             [[ptBoolean,true]]),
167
168   )
169 ; (
170   msrNav(ColctAlertsNearBy,
171             [rnTheCrisis,msrAny,msrTrue],
172             [ActCrisis])
173   )
174 ),
175
176 /* PostF04 */
177
178 msrNav([ActAlert],
179         [msmAtPost,rnTheCrisis],
180         [ActCrisis]),
181
182 /* PostF05 */
183
184 msrNav([TheSystem],
185         [rnctHuman,
186           msrSelect,id,eq,[AdtPhoneNumber]],
187         HumanColl),
188
189 msrNav(HumanColl,
190         [msrSelect,kind,etEq,[AetHumanKind]],
191         HumanCol2),
192
193 (msrNav(HumanCol2,[msrIsEmpty],[[ptBoolean,true]]))
194 -> (msrNav([ActHuman],
195             [init,[AdtPhoneNumber,AetHumanKind]],
196             [[ptBoolean,true]]),
197   msrNav([ActHuman],
198             [msmAtPost,rnactComCompany],
199             [TheactComCompany])
200   )
201 ; msrNav(HumanCol2,
202             [msrAny],
203             [ActHuman])
204 ),
205
206msrNav([ActHuman],
207         [rnSignaled,msrIncluding,[ActAlert]],
208         ColAlerts),
209
210msrNav([ActHuman],
211         [msmAtPost,rnSignaled],
212         ColAlerts),
213
214/* PostF06 */
215msrNav([AdtSMS],
216         [value],
217         [[ptString,'Your alert has been registered. We will handle it and keep you informed']])),
218msrNav([TheactComCompany],
219         [rnInterfaceIN,
220           ieSmsSend,[AdtPhoneNumber,
221                         AdtSMS]],[[ptBoolean,true]]),
222
223/*
224
225 */
226
227 /* Post Protocol:*/
228 /* PostP01 */
229 true

```

230 .

Listing D.7: Prolog file outactComCompany-oeAlert.pl.

D.8 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoord oeCloseCrisis.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeCloseCrisis,
8    [preProtocol,Self,
9     AdtCrisisID
10    ],
11   []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17 .
18/* PreP01 */
19 msrNav([TheSystem],
20        [vpStarted],
21        [[ptBoolean,true]]),
22 .
23/* PreP02 */
24 msrNav([TheActor],
25        [rnctAuthenticated,vpIsLogged],
26        [[ptBoolean,true]]),
27 .
28
29msrop(outactCoordinator,
30    oeCloseCrisis,
31    [preFunctional,Self,
32     AdtCrisisID
33    ],
34   []):-!
35/* Pre Functional:*/
36 msrVar(ctState,TheSystem),
37 msrVar(actCoordinator,TheActor),
38 .
39 msrVar(dtCrisisID,AdtCrisisID),
40 .
41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
42 msrNav([Self],[rnActor],[TheActor]),
43 .
44/* PreF01 */
45 msrNav([TheSystem],
46        [rnctCrisis,
47         msrSelect,
48         id,eq,[AdtCrisisID]
49       ],
50       ColCrisis),
51 .
52 msrNav(ColCrisis,
53        [msrSize,eq,[[ptInteger,1]]],
54        [[ptBoolean,true]]),
55 .
56
57msrop(outactCoordinator,
58    oeCloseCrisis,
59    [post,Self,
60     AdtCrisisID
61    ],

```

```

62      []):-  

63  

64 /* Post Functional:*/  

65 msrVar(ctState,TheSystem),  

66 msrVar(actCoordinator,TheActor),  

67  

68 msrVar(ctCrisis,TheCrisis),  

69 msrVar(dtCrisisID,AdtCrisisID),  

70  

71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

72 msrNav([Self],[rnActor],[TheActor]),  

73  

74 /* PostF01 */  

75 msrNav([TheSystem],  

76     [rnctCrisis,  

77      msrSelect,  

78      id,eq,[AdtCrisisID]],  

79      [TheCrisis]),  

80  

81 msrNav([TheCrisis],  

82     [msmAtPost,status],  

83     [[etCrisisStatus,closed]]),  

84  

85 /* PostF02 */  

86 msrNav([TheCrisis],  

87     [msmAtPost,rnHandler],  

88     []),  

89  

90 /* PostF03 */  

91 msrNav([TheCrisis],  

92     [rnAlerts,msrForAll,msrIsKilled],  

93     [[ptBoolean,true]]),  

94  

95 /* PostF04 */  

96 msrNav([TheActor],  

97     [rnInterfaceIN,  

98      ieMessage,[[ptString,'The crisis is now closed !']]  

99    ],  

100   [[ptBoolean,true]]),  

101  

102 /* Post Protocol:*/  

103 /* PostP01 */  

104 true  

105 .

```

Listing D.8: Prolog file outactCoordinator-oeCloseCrisis.pl.

D.9 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeGetAlertsSet.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */  

3:- multifile msrop/4.  

4%%%%%%%%%%%%%%%
5-----  

6msrop(outactCoordinator,  

7 oeGetAlertsSet,  

8 [preProtocol,Self,  

9 AetAlertStatus  

10 ],  

11 []):-  

12 /* Pre Protocol:*/  

13 msrVar(ctState,TheSystem),  

14 msrVar(actCoordinator,TheActor),  

15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

16 msrNav([Self],[rnActor],[TheActor]),  

17  

18 /* PreP01 */

```

```

19 msrNav([TheSystem],
20   [vpStarted],
21   [[ptBoolean,true]]),
22 .
23 msrNav([TheActor],
24   [rnctAuthenticated,vpIsLogged],
25   [[ptBoolean,true]])
26 .
27
28 msrop(outactCoordinator,
29   oeGetAlertsSet,
30   [preFunctional,Self,
31   AetAlertStatus
32   ],
33   []):-!
34 /* Pre Functional:*/
35 /* PreF01 */
36 true
37 .
38
39 msrop(outactCoordinator,
40   oeGetAlertsSet,
41   [post,Self,
42   AetAlertStatus
43   ],
44   []):-!
45
46 /* Post Functional:*/
47 msrVar(ctState,TheSystem),
48 msrVar(actCoordinator,TheActor),
49 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
50 msrNav([Self],[rnActor],[TheActor]),
51
52 /* PostF01 */
53 msrNav([TheSystem],
54   [rnctAlert,
55   msrSelect,
56   status,etEq,[AetAlertStatus]],
57   ColAlertSet),
58
59 msrNav(ColAlertSet,
60   [msrForAll,isSentToCoordinator,[TheActor]],
61   [[ptBoolean,true]]),
62
63 /* Post Protocol:*/
64 /* PostP01 */
65 true
66 .

```

Listing D.9: Prolog file outactCoordinator-oeGetAlertsSet.pl.

D.10 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeGetCrisisSet.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7   oeGetCrisisSet,
8   [preProtocol,Self,
9   AetCrisisStatus
10  ],
11  []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),

```

```

15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29 oeGetCrisisSet,
30 [preFunctional,Self,
31 AetCrisisStatus
32 ],
33 []):-!
34/* Pre Functional:*/
35/* PreF01 */
36true
37.
38
39msrop(outactCoordinator,
40 oeGetCrisisSet,
41 [post,Self,
42 AetCrisisStatus
43 ],
44 []):-!
45
46/* Post Functional:*/
47 msrVar(ctState,TheSystem),
48 msrVar(actCoordinator,TheActor),
49 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
50 msrNav([Self],[rnActor],[TheActor]),
51
52/* PostF01 */
53 msrNav([TheSystem],
54     [rnctCrisis,
55      msrSelect,
56      status,etEq,[AetCrisisStatus]],
57     ColCrisisSet),
58
59 msrNav(ColCrisisSet,
60     [msrForAll,isSentToCoordinator,[TheActor]],
61     [[ptBoolean,true]]),
62
63 /* Post Protocol:*/
64/* PostP01 */
65 true
66 .

```

Listing D.10: Prolog file outactCoordinator-oeGetCrisisSet.pl.

D.11 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeInvalidateAlert.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeInvalidateAlert,
8    [preProtocol,Self,
9     AdtAlertID
10    ],

```

```

11  []):-  

12 /* Pre Protocol:*/  

13 msrVar(ctState,TheSystem),  

14 msrVar(actCoordinator,TheActor),  

15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

16 msrNav([Self],[rnActor],[TheActor]),  

17  

18 /* PreP01 */  

19 msrNav([TheSystem],  

20     [vpStarted],  

21     [[ptBoolean,true]]),  

22  

23 /* PreP02 */  

24 msrNav([TheActor],  

25     [rnctAuthenticated,vpIsLogged],  

26     [[ptBoolean,true]]))  

27.  

28  

29 msrop(outactCoordinator,  

30     oeInvalidateAlert,  

31     [preFunctional,Self,  

32      AdtAlertID  

33      ],  

34      []):-  

35 /* Pre Functional:*/  

36 msrVar(ctState,TheSystem),  

37 msrVar(actCoordinator,TheActor),  

38  

39 msrVar(dtAlertID,AdtAlertID),  

40  

41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

42 msrNav([Self],[rnActor],[TheActor]),  

43  

44 /* PreF01 */  

45 msrNav([TheSystem],  

46     [rnctAlert,  

47      msrSelect,  

48      id,eq,[AdtAlertID]  

49      ],  

50      ColAlert),  

51  

52 msrNav(ColAlert,  

53     [msrSize,eq,[[ptInteger,1]]],  

54     [[ptBoolean,true]]))  

55 .  

56  

57 msrop(outactCoordinator,  

58     oeInvalidateAlert,  

59     [post,Self,  

60      AdtAlertID  

61      ],  

62      []):-  

63  

64 /* Post Functional:*/  

65 msrVar(ctState,TheSystem),  

66 msrVar(actCoordinator,TheActor),  

67  

68 msrVar(ctAlert,TheAlert),  

69 msrVar(dtAlertID,AdtAlertID),  

70  

71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

72 msrNav([Self],[rnActor],[TheActor]),  

73  

74 /* PostF01 */  

75 msrNav([TheSystem],  

76     [rnctAlert,  

77      msrSelect,  

78      id,eq,[AdtAlertID]],  

79      [TheAlert]),  

80

```

```

81 msrNav([TheAlert],
82     [msmAtPost,status],
83     [[etAlertStatus,invalid]]),
84
85 /* PostF02 */
86 msrNav([TheActor],
87     [rnInterfaceIN,
88     ieMessage,[[ptString,'The alert is now declared as invalid !']],
89     ],
90     [[ptBoolean,true]]),
91
92 /* Post Protocol:*/
93 /* PostP01 */
94 true
95 .

```

Listing D.11: Prolog file outactCoordinator-oeInvalidateAlert.pl.

D.12 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeReportOnCrisis.pl

```

1%-----%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%-----%
5-----%
6msrop(outactCoordinator,
7    oeReportOnCrisis,
8    [preProtocol,Self,
9     AdtCrisisID,
10    AdtComment
11    ],
12    []):-!
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actCoordinator,TheActor),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheActor]),
18
19/* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]]),
27.
28
29msrop(outactCoordinator,
30    oeReportOnCrisis,
31    [preFunctional,Self,
32     AdtCrisisID,
33     AdtComment
34     ],
35    []):-!
36/* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45/* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,

```

```

48     msrSelect,
49     id,eq,[AdtCrisisID]
50   ],
51   ColCrisis),
52
53 msrNav(ColCrisis,
54   [msrSize,eq,[[ptInteger,1]]],
55   [[ptBoolean,true]])
56 .
57
58msrop(outactCoordinator,
59   oeReportOnCrisis,
60   [post,Self,
61   AdtCrisisID,
62   AdtComment
63   ],
64   []):-!
65
66/* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(dtComment,AdtComment),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77/* PostF01 */
78 msrNav([TheSystem],
79   [rnctCrisis,
80    msrSelect,
81    id,eq,[AdtCrisisID]],
82   [TheCrisis]),
83
84 msrNav([TheCrisis],
85   [msmAtPost,comment],
86   [AdtComment]),
87
88 msrNav([TheActor],
89   [rnInterfaceIN,
90   ieMessage,[[ptString,'The crisis comment has been updated !']]
91   ],
92   [[ptBoolean,true]]),
93
94/* Post Protocol:*/
95/* PostP01 */
96 true
97 .

```

Listing D.12: Prolog file outactCoordinator-oeReportOnCrisis.pl.

D.13 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeSetCrisisHandler.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7   oeSetCrisisHandler,
8   [preProtocol,Self,
9   AdtCrisisID
10  ],
11  []):-!
12/* Pre Protocol:*/

```

```

13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18 /* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]]))
26.
27
28msrop(outactCoordinator,
29 oeSetCrisisHandler,
30 [preFunctional,Self,
31 AdtCrisisID
32 ],
33 []):-!
34 /* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actCoordinator,TheActor),
37
38 msrVar(dtCrisisID,AdtCrisisID),
39
40 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
41 msrNav([Self],[rnActor],[TheActor]),
42
43 /* PreF01 */
44 msrNav([TheSystem],
45     [rnctCrisis,
46      msrSelect,
47      id,eq,[AdtCrisisID]
48 ],
49     ColCrisis),
50
51 msrNav(ColCrisis,
52     [msrSize,eq,[[ptInteger,1]]],
53     [[ptBoolean,true]]))
54 .
55
56msrop(outactCoordinator,
57 oeSetCrisisHandler,
58 [post,Self,
59 AdtCrisisID
60 ],
61 []):-!
62
63 /* Post Functional:*/
64 msrVar(ctState,TheSystem),
65 msrVar(actCoordinator,TheActor),
66 msrVar(ctCoordinator,TheCoordinator),
67 msrVar(ctCoordinator,TheCurrentHandler),
68
69 msrVar(ctCrisis,TheCrisis),
70 msrVar(dtCrisisID,AdtCrisisID),
71
72 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
73 msrNav([Self],[rnActor],[TheActor]),
74
75 /* PostF01 */
76 msrNav([TheSystem],
77     [rnctCrisis,
78      msrSelect,
79      id,eq,[AdtCrisisID]],
80     [TheCrisis]),
81
82 msrNav([TheCrisis],

```

```

83     [msmAtPost, status],
84     [[etCrisisStatus, handled]]),
85
86 msrNav([TheActor],
87     [rnctCoordinator],
88     [TheCoordinator]),
89 msrNav([TheCrisis],
90     [msmAtPost, rnHandler],
91     [TheCoordinator]),
92
93 msrNav([TheActor],
94     [rnInterfaceIN,
95      ieMessage, [[ptString, 'You are now considered as handling the crisis !']]],
96      ],
97      [[ptBoolean,true]]),
98
99 /* PostF02 */
100 msrNav([TheCrisis],
101     [rnAlerts, msrForAll, isSentToCoordinator, [TheActor]],
102     [[ptBoolean,true]]),
103
104 /* PostF03 */
105 ( msrNav([TheCrisis],
106     [rnHandler, msrSize, eq, [[ptInteger, 1]]],
107     [[ptBoolean,true]]))
108 -> (msrNav([TheCrisis],
109     [rnHandler],
110     [TheCurrentHandler]),
111     msrNav([TheCurrentHandler],
112     [rnactCoordinator, rnInterfaceIN,
113      ieMessage, [[ptString, 'One of the crisis you were handling is now handled by one of your
114      colleagues!']]],
115      [[ptBoolean,true]]])
116 )
117 ; true
118 ),
119
120 /* PostF04 */
121 msrNav([TheCrisis],
122     [rnAlerts, rnSignaler, msrForAll, isAcknowledged, []],
123     [[ptBoolean,true]]),
124
125 /* Post Protocol:*/
126 /* PostP01 */
127 true
128 .

```

Listing D.13: Prolog file outactCoordinator-oeSetCrisisHandler.pl.

D.14 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeSetCrisisStatus.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeSetCrisisStatus,
8    [preProtocol, Self,
9     AdtCrisisID,
10    AetCrisisStatus
11    ],
12    []):-!
13/* Pre Protocol:*/
14 msrVar(ctState, TheSystem),
15 msrVar(actCoordinator, TheActor),

```

```

16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheActor]),
18
19 /* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]])
27.
28
29msrop(outactCoordinator,
30 oeSetCrisisStatus,
31 [preFunctional,Self,
32 AdtCrisisID,
33 AetCrisisStatus
34 ],
35 []):-!
36 /* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45 /* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,
48      msrSelect,
49      id,eq,[AdtCrisisID]
50 ],
51 ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize,eq,[[ptInteger,1]]],
55     [[ptBoolean,true]]))
56 .
57
58msrop(outactCoordinator,
59 oeSetCrisisStatus,
60 [post,Self,
61 AdtCrisisID,
62 AetCrisisStatus
63 ],
64 []):-!
65
66 /* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(etCrisisStatus,AetCrisisStatus),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77 /* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80      msrSelect,
81      id,eq,[AdtCrisisID]],
82     [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,status],

```

```

86     [AetCrisisStatus]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90     ieMessage,[[ptString,'The crisis status has been updated !']])
91 ],
92 [[ptBoolean,true]]),
93
94 /* Post Protocol:*/
95 /* PostP01 */
96 true
97 .

```

Listing D.14: Prolog file outactCoordinator-oeSetCrisisStatus.pl.

D.15 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeSetCrisisType.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeSetCrisisType,
8    [preProtocol,Self,
9     AdtCrisisID,
10    AetCrisisType
11    ],
12    []):-!
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actCoordinator,TheActor),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheActor]),
18
19/* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated,vpiIsLogged],
26     [[ptBoolean,true]]))
27.
28
29msrop(outactCoordinator,
30    oeSetCrisisType,
31    [preFunctional,Self,
32     AdtCrisisID,
33     AetCrisisType
34     ],
35     []):-!
36/* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45/* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,
48      msrSelect,
49      id,eq,[AdtCrisisID]
50     ],

```

```

51     ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize, eq, [[ptInteger, 1]]], 
55     [[ptBoolean, true]])
56 .
57
58 msrop(outactCoordinator,
59     oeSetCrisisType,
60     [post, Self,
61      AdtCrisisID,
62      AetCrisisType
63     ],
64     []):-!
65
66 /* Post Functional:*/
67 msrVar(ctState, TheSystem),
68 msrVar(actCoordinator, TheActor),
69
70 msrVar(ctCrisis, TheCrisis),
71 msrVar(dtCrisisID, AdtCrisisID),
72 msrVar(etCrisisType, AetCrisisType),
73
74 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
75 msrNav([Self], [rnActor], [TheActor]),
76
77 /* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80      msrSelect,
81      id, eq, [AdtCrisisID]],
82     [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost, type],
86     [AetCrisisType]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90      ieMessage, [[ptString, 'The crisis type has been updated !']]
91     ],
92     [[ptBoolean, true]]),
93
94 /* Post Protocol:*/
95 /* PostP01 */
96 true
97 .

```

Listing D.15: Prolog file outactCoordinator-oeSetCrisisType.pl.

D.16 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeValidateAlert.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeValidateAlert,
8    [preProtocol, Self,
9     AdtAlertID
10    ],
11    []):-!
12/* Pre Protocol:*/
13 msrVar(ctState, TheSystem),
14 msrVar(actCoordinator, TheActor),
15 msrNav([Self], [rnActor, rnSystem], [TheSystem]),

```

```

16 msrNav([Self], [rnActor], [TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpiIsLogged],
25     [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29    oeValidateAlert,
30    [prefunctional,Self,
31     AdtAlertID
32     ],
33     []):-!
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actCoordinator,TheActor),
37
38 msrVar(dtAlertID,AdtAlertID),
39
40 msrNav([Self], [rnActor,rnSystem],[TheSystem]),
41 msrNav([Self], [rnActor], [TheActor]),
42
43/* PreF01 */
44 msrNav([TheSystem],
45     [rnctAlert,
46      msrSelect,
47      id,eq,[AdtAlertID]
48      ],
49     ColAlerts),
50
51 msrNav(ColAlerts,
52     [msrSize,eq,[[ptInteger,1]]],
53     [[ptBoolean,true]]))
54 .
55
56msrop(outactCoordinator,
57    oeValidateAlert,
58    [post,Self,
59     AdtAlertID
60     ],
61     []):-!
62
63/* Post Functional:*/
64 msrVar(ctState,TheSystem),
65 msrVar(actCoordinator,TheActor),
66
67 msrVar(ctAlert,TheAlert),
68 msrVar(dtAlertID,AdtAlertID),
69
70 msrNav([Self], [rnActor,rnSystem],[TheSystem]),
71 msrNav([Self], [rnActor], [TheActor]),
72
73/* PostF01 */
74 msrNav([TheSystem],
75     [rnctAlert,
76      msrSelect,
77      id,eq,[AdtAlertID]],
78     [TheAlert]),
79
80 msrNav([TheAlert],
81     [msmAtPost,status],
82     [[etAlertStatus,valid]]),
83
84 msrNav([TheActor],
85     [rnInterfaceIN,

```

```

86     ieMessage, [[ptString, 'The Alert is now declared as valid !']])
87     ],
88     [[ptBoolean,true])),
89
90 /* Post Protocol:*/
91/* PostP01 */
92true
93 .

```

Listing D.16: Prolog file outactCoordinator-oeValidateAlert.pl.

D.17 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactMsrCreator-oeCreateSystemAndEnvironment.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5/*
6*****
7MSRCreatorActor
8*****
9
10/** createSystemAndEnvironment ***/
11
12msrop(outactMsrCreator,
13    oeCreateSystemAndEnvironment,
14    [preFunctional,_Self,_AqtyComCompanies],
15    []):-!
16 true.
17
18msrop(outactMsrCreator,
19    oeCreateSystemAndEnvironment,
20    [preProtocol,_Self,_AqtyComCompanies],
21    []):-!
22 true.
23
24msrop(outactMsrCreator,
25    oeCreateSystemAndEnvironment,
26    [post,_Self,AqtyComCompanies],
27    []):-!
28
29 msrVar(ctState,TheSystem),
30 msrVar(actMsrCreator,AactMsrCreator),
31 msrVar(actAdministrator,AactAdministrator),
32
33 msrVar(dtInteger, AnextValueForAlertID),
34 msrVar(dtInteger, AnextValueForCrisisID),
35 msrVar(dtDateAndTime, Aclock),
36 msrVar(dtSecond, AcrisisReminderPeriod),
37 msrVar(dtSecond, AmaxCrisisReminderPeriod),
38 msrVar(ptBoolean, AvpStarted),
39
40 /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
41 msrNav([AnextValueForAlertID],
42     [value,eq,[[ptInteger,1]]],
43     [[ptBoolean,true]]),
44
45 msrNav([AnextValueForCrisisID],
46     [value,eq,[[ptInteger,1]]],
47     [[ptBoolean,true]]),
48
49msrNav([Aclock],
50     [date,year,value],
51     [[ptInteger,1970]]),
52msrNav([Aclock],
53     [date,month,value],
54     [[ptInteger,01]]),

```

```

55msrNav ([Aclock],
56    [date,day,value],
57    [[ptInteger,01]]),
58
59msrNav ([Aclock],
60    [time,hour,value],
61    [[ptInteger,00]]),
62msrNav ([Aclock],
63    [time,minute,value],
64    [[ptInteger,00]]),
65msrNav ([Aclock],
66    [time,second,value],
67    [[ptInteger,00]]),
68
69 msrNav ([AcrisisReminderPeriod],
70    [value,eq,[[ptInteger,300]]],
71    [[ptBoolean,true]]),
72
73 msrNav ([AmaxCrisisReminderPeriod],
74    [value,eq,[[ptInteger,1200]]],
75    [[ptBoolean,true]]),
76
77 msrNav ([AvpStarted],
78    [],
79    [[ptBoolean,true]]),
80
81 msrNav ([TheSystem],
82    [init, [AnextValueForAlertID,
83        AnextValueForCrisisID,
84        Aclock,
85        AcrisisReminderPeriod,
86        AmaxCrisisReminderPeriod,
87        Aclock,
88        AvpStarted]
89    ],
90    [[ptBoolean,true]]),
91
92/* PostF02*/
93 msrNav ([AactMsrCreator],
94    [init, []],
95    [[ptBoolean,true]]),
96
97 /* PostF03 */
98 msrVarCol(actComCompany,AqtyComCompanies,AactComCompanyCol),
99
100 msrNav (AactComCompanyCol,
101    [msrForAll,init,[]],
102    [[ptBoolean,true]]),
103
104 /* PostF04*/
105 msrNav ([AactAdministrator],
106    [init, []],
107    [[ptBoolean,true]]),
108
109 /* PostF05*/
110 msrVar(actActivator,AactActivator),
111 msrNav ([AactActivator],
112    [init, []],
113    [[ptBoolean,true]]),
114
115/* PostF06 */
116 msrVar(ctAdministrator,ActAdministrator),
117 msrVar(dtLogin,AdtLogin),
118 msrVar(dtPassword,AdtPassword),
119
120 msrNav ([AdtLogin],
121    [value,eq,[[ptString,'icrashadmin']]],
122    [[ptBoolean,true]]),
123
124 msrNav ([AdtPassword],

```

```

125      [value,eq,[[ptString,'7WXC1359']]],  

126      [[ptBoolean,true]]),  

127  

128 msrNav([ActAdministrator],  

129     [init,[AdtLogin,AdtPassword]],  

130     [[ptBoolean,true]]),  

131  

132 /* PostF07 */  

133 msrNav([ActAdministrator],  

134     [msmAtPost,rnactAuthenticated],  

135     [AactAdministrator]),  

136  

137 /* Post Protocol:*/  

138 /* PostP01 */  

139 true  

140 .

```

Listing D.17: Prolog file outactMsrCreator-oeCreateSystemAndEnvironment.pl.

D.18 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClass-ctAdministrator-init.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */  

3:- multifile msrop/4.  

4%%%%%%%%%%%%%%%
5  

6msrop(ctAdministrator,init,[Self,  

7          Alogin,  

8          Apwd],  

9          Result):-  

10 (  

11msrVar(ctAdministrator,Self),  

12  

13/* Post F01 */  

14msrNav([Self],[login],[Alogin]),  

15msrNav([Self],[pwd],[Apwd]),  

16msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),  

17  

18/* Post F02 */  

19 msrNav([Self],[msrIsNew],[Self])  

20)  

21-> Result = [ptBoolean,true]  

22; Result = [ptBoolean,false]  

23.

```

Listing D.18: Prolog file PrimaryTypesClasses-ctAdministrator-init.pl.

D.19 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClass-ctAlert-init.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */  

3:- multifile msrop/4.  

4%%%%%%%%%%%%%%%
5  

6msrop(ctAlert,init,[Self,  

7          Aid,  

8          Astatus,  

9          Alocation,  

10         Ainstant,  

11         Acomment],  

12         Result):-  

13  

14/* Post F01 */  

15 (

```

```

16msrVar(ctAlert,Self) ,
17
18msrNav([Self],[id],[Aid]),
19msrNav([Self],[status],[Astatus]),
20msrNav([Self],[location],[Alocation]),
21msrNav([Self],[instant],[Ainstant]),
22msrNav([Self],[comment],[Acomment]),
23
24/* Post F02 */
25 msrNav([Self],[msrIsNew], [Self])
26)
27-> Result = [ptBoolean,true]
28; Result = [ptBoolean,false]
29.

```

Listing D.19: Prolog file PrimaryTypesClasses-ctAlert-init.pl.

D.20 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctAlert-isSentToCoordinator.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctAlert,isSentToCoordinator,[Self,AactCoordinator],
7      Result):-
8
9/* Post F01 */
10(
11 msrNav([AactCoordinator],
12        [rnInterfaceIN,ieSendAnAlert,[Self] ],
13        [[ptBoolean,true]])
14)
15-> Result = [ptBoolean,true]
16; Result = [ptBoolean,false]
17.

```

Listing D.20: Prolog file PrimaryTypesClasses-ctAlert-isSentToCoordinator.pl.

D.21 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctAuthenticated-init.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctAuthenticated,init,[Self,
7          Alogin,
8          Apwd],
9      Result):-
10
11/* Post F01 */
12(
13msrVar(ctAuthenticated,Self),
14
15msrNav([Self],[login],[Alogin]),
16msrNav([Self],[pwd],[Apwd]),
17msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),
18
19/* Post F02 */
20 msrNav([Self],[msrIsNew], [Self])
21)
22-> Result = [ptBoolean,true]
23; Result = [ptBoolean,false]

```

24.

Listing D.21: Prolog file PrimaryTypesClasses-ctAuthenticated-init.pl.

D.22 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCoordinator-init.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5
6msrop(ctCoordinator,init,[Self,
7      Aid,
8      Alogin,
9      Apwd],
10     Result):-
11
12/* Post F01 */
13(
14msrVar(ctCoordinator,Self),
15
16msrNav([Self],[id],[Aid]),
17msrNav([Self],[login],[Alogin]),
18msrNav([Self],[pwd],[Apwd]),
19msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),
20
21/* Post F02 */
22 msrNav([Self],[msrIsNew],[Self])
23)
24-> Result = [ptBoolean,true]
25; Result = [ptBoolean,false]
26.

```

Listing D.22: Prolog file PrimaryTypesClasses-ctCoordinator-init.pl.

D.23 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-handlingDelayPassed.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,handlingDelayPassed,[Self],
7     Result):-
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,LastReminderSecondsQty),
14 msrVar(dtSecond,CrisisReminderPeriod),
15
16 msrNav([Self],[rnSystem],[TheSystem]),
17
18 msrNav([Self],
19      [status],
20      [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23      [clock,toSecondsQty,[],],
24      [CurrentClockSecondsQty]),
25
26 msrNav([TheSystem],
27      [vpLastReminder,toSecondsQty,[]],

```

```

28     [LastReminderSecondsQty]),
29
30 msrNav([TheSystem],
31     [crisisReminderPeriod],
32     [CrisisReminderPeriod]),
33
34 msrNav([CurrentClockSecondsQty],
35     [sub, [LastReminderSecondsQty],
36         gt, [CrisisReminderPeriod]
37     ],
38     [[ptBoolean,true]])
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.

```

Listing D.23: Prolog file PrimaryTypesClasses-ctCrisis-handlingDelayPassed.pl.

D.24 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-init.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,init,[Self,
7    Aid,
8    Atype,
9    Astatus,
10   Alocation,
11   Ainstant,
12   Acomment],
13   Result):-
14
15/* Post F01 */
16(
17msrVar(ctCrisis,Self),
18
19msrNav([Self],[id],[Aid]),
20msrNav([Self],[type],[Atype]),
21msrNav([Self],[status],[Astatus]),
22msrNav([Self],[location],[Alocation]),
23msrNav([Self],[instant],[Ainstant]),
24msrNav([Self],[comment],[Acomment]),
25
26/* Post F02 */
27 msrNav([Self],[msrIsNew],[Self])
28)
29-> Result = [ptBoolean,true]
30; Result = [ptBoolean,false]
31.

```

Listing D.24: Prolog file PrimaryTypesClasses-ctCrisis-init.pl.

D.25 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-isAllocatedIfPossible.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,isAllocatedIfPossible,[Self],
7   Result):-

```

```

8(
9 msrVar(ctState,TheSystem),
10 msrNav([Self],[rnSystem],[TheSystem]),
11
12 msrVar(actCoordinator,TheCoordinatorActor),
13 msrVar(ctCoordinator,TheCoordinator),
14 msrVar(ptString,TheMessage),
15 msrVar(ptString,TheCrisisIDptString),
16
17 (
18 /* Post F01 */
19 msrNav([Self],
20 [maxHandlingDelayPassed,[]],
21 [[ptBoolean,true]]),
22
23 ( msrNav([TheSystem],
24 [rnactCoordinator,msrIsEmpty],
25 [[ptBoolean,false]])
26 -> (
27 /* Post F02 */
28 msrNav([TheSystem],
29 [rnactCoordinator,msrAny,msrTrue],
30 [TheCoordinatorActor]),
31
32 msrNav([TheCoordinatorActor],
33 [rnctCoordinator],
34 [TheCoordinator]),
35
36 msrNav([Self],
37 [msmAtPost,rnHandler],
38 [TheCoordinator]),
39
40 msrNav([Self],
41 [msmAtPost,status],
42 [[etCrisisStatus,handled]]),
43
44 msrNav([Self],
45 [id,value],
46 [TheCrisisIDptString]),
47
48 msrNav([[ptString,'You are now considered as handling the crisis having ID: ']],
49 [ptStringConcat,[TheCrisisIDptString]],
50 [TheMessage]),
51
52 msrNav([TheCoordinatorActor],
53 [rnInterfaceIN,
54 ieMessage,[TheMessage]
55 ],
56 [[ptBoolean,true]])
57 )
58 ; /* Post F03 */
59 msrNav([TheSystem],
60 [rnactAdministrator,msrForAll,rnInterfaceIN,
61 ieMessage,[[ptString,'Please add new coordinators to handle pending crisis !']]],
62 [[ptBoolean,true]])
63 )
64 )
65 )
66)
67-> Result = [ptBoolean,true]
68; Result = [ptBoolean,false]
69.

```

Listing D.25: Prolog file PrimaryTypesClasses-ctCrisis-isAllocatedIfPossible.pl.

D.26 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClass-ctCrisis-isSentToCoordinator.pl

%%%%%%%%%%%%%

```

2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,isSentToCoordinator,[Self,AactCoordinator],
7      Result):-_
8
9/* Post F01 */
10(
11 msrNav([AactCoordinator],
12         [rnInterfaceIN,ieSendACrisis,[Self]],[[ptBoolean,true]])
13
14)
15-> Result = [ptBoolean,true]
16; Result = [ptBoolean,false]
17.

```

Listing D.26: Prolog file PrimaryTypesClasses-ctCrisis-isSentToCoordinator.pl.

D.27 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-maxHandlingDelayPassed.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,maxHandlingDelayPassed,[Self],
7      Result):-_
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,CrisisInstantSecondsQty),
14 msrVar(dtSecond,MaxCrisisReminderPeriod),
15
16 msrNav([Self], [rnSystem], [TheSystem]),
17
18 msrNav([Self],
19         [status],
20         [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23         [clock,toSecondsQty,[]],
24         [CurrentClockSecondsQty]),
25
26 msrNav([Self],
27         [instant,toSecondsQty,[],],
28         [CrisisInstantSecondsQty]),
29
30 msrNav([TheSystem],
31         [maxCrisisReminderPeriod],
32         [MaxCrisisReminderPeriod]),
33
34 msrNav([CurrentClockSecondsQty],
35         [sub,[CrisisInstantSecondsQty],
36          gt, [MaxCrisisReminderPeriod]
37          ],
38         [[ptBoolean,true]]))
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.

```

Listing D.27: Prolog file PrimaryTypesClasses-ctCrisis-maxHandlingDelayPassed.pl.

D.28 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctHuman-init.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctHuman,init,[Self,
7          Aid,
8          Akind],
9      Result):-!
10
11/* Post F01 */
12(
13msrVar(ctHuman,Self),
14
15msrNav([Self],[id],[Aid]),
16msrNav([Self],[kind],[Akind]),
17
18/* Post F02 */
19 msrNav([Self],[msrIsNew],[Self])
20)
21-> Result = [ptBoolean,true]
22; Result = [ptBoolean,false]
23.
```

Listing D.28: Prolog file PrimaryTypesClasses-ctHuman-init.pl.

D.29 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctHuman-isAcknowledged.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctHuman,isAcknowledged,[Self],Result):-
7
8/* Post F01 */
9(msrVar(dtPhoneNumber,AdtPhoneNumber),
10 msrVar(dtSMS,AdtSMS),
11
12 msrNav([Self],
13         [id,eq,[AdtPhoneNumber]],
14         [[ptBoolean,true]]),
15 msrNav([AdtSMS],
16         [value,eq,[[ptString,'The handling of your alert by our services is in progress !']]],
17         [[ptBoolean,true]]),
18 msrNav([Self],
19         [rnactComCompany,rnInterfaceIN,ieSmsSend,[AdtPhoneNumber,AdtSMS]],
20         [[ptBoolean,true]]),
21)
22-> Result = [ptBoolean,true]
23; Result = [ptBoolean,false]
24.
```

Listing D.29: Prolog file PrimaryTypesClasses-ctHuman-isAcknowledged.pl.

D.30 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctState-init.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
```

```

4%%%%%%%%%%%%%
5
6msrop(ctState,init,[Self,
7      AnextValueForAlertID,
8      AnextValueForCrisisID,
9      Aclock,
10     AcrisisReminderPeriod,
11     AmaxCrisisReminderPeriod,
12     AvpLastReminder,
13     AvpStarted],
14   Result):-
15
16 /* Post F01 */
17(
18 msrVar(ctState,Self),
19
20 msrNav([Self],[nextValueForAlertID],[AnextValueForAlertID]),
21 msrNav([Self],[nextValueForCrisisID],[AnextValueForCrisisID]),
22 msrNav([Self],[clock],[Aclock]),
23 msrNav([Self],[crisisReminderPeriod],[AcrisisReminderPeriod]),
24 msrNav([Self],[maxCrisisReminderPeriod],[AmaxCrisisReminderPeriod]),
25 msrNav([Self],[vpLastReminder],[AvpLastReminder]),
26 msrNav([Self],[vpStarted],[AvpStarted]),
27
28 msrNav([Self],[msrIsNew],[Self])
29)
30-> Result = [ptBoolean,true]
31; Result = [ptBoolean,false]
32.

```

Listing D.30: Prolog file PrimaryTypesClasses-ctState-init.pl.

D.31 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataty... dtAlertID-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(dtAlertID,is,[AdtValue],Result):-
7% msd01
8msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]],
12   [[ptBoolean,true]]),
13   msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,20]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20TheResult = Result
21.
22
23/*
24| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]]],[]]],,
25msrNav([X],[is,[],[Result]).
26
27X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]]],[]]],,
28Result = [ptBoolean,true] ?
29
30yes
31
32| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'012345678901234567890123456789']]]],[]]],,
33msrNav([X],[is,[],[Result]).
```

Listing D.31: Prolog file PrimaryTypesDatatypes-dtAlertID-is.pl.

D.32 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataComment-is.pl

Listing D.32: Prolog file PrimaryTypesDatatypes-dtComment-is.pl.

D.33 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataCoordinatorID-is.pl

```

7% msd01
8 msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]]),
12   [[ptBoolean,true]]),
13 msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,5]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20 TheResult = Result
21.

```

Listing D.33: Prolog file PrimaryTypesDatatypes-dtCoordinatorID-is.pl.

D.34 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtCrisisID-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(dtCrisisID,is,[AdtValue],Result):-
7% msd01
8 msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]]),
12   [[ptBoolean,true]]),
13 msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,10]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20 TheResult = Result
21.
22/*
23| ?- X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789']]]],[]]],,
24msrNav([X],[is,[],[Result]]).
25X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789']]]],[]]],,
26Result = [ptBoolean,true] ?
27yes
28
29| ?- X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789a']]]],[]]],,
30msrNav([X],[is,[],[Result]]).
31X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789a']]]],[]]],,
32Result = [ptBoolean,false] ?
33yes
34*/

```

Listing D.34: Prolog file PrimaryTypesDatatypes-dtCrisisID-is.pl.

D.35 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtGPSLocation-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5

```

```

6%% dtPhoneNumber
7
8% msd01
9msrop(dtGPSLocation, is, [AdtValue], Result) :-
10msrVar(ptBoolean, TheResult),
11(
12(
13    msrNav([AdtValue],
14        [latitude, is, []],
15        [[ptBoolean, true]]),
16    msrNav([AdtValue],
17        [longitude, is, []],
18        [[ptBoolean, true]])
19)
20 -> TheResult = [ptBoolean, true]
21 ; TheResult = [ptBoolean, false]
22),
23
24 Result = TheResult
25.

```

Listing D.35: Prolog file PrimaryTypesDatatypes-dtGPSLocation-is.pl.

D.36 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtGPSLocation-isNearTo.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% dtGPSLocation
7
8msrop(dtGPSLocation, isNearTo, [Self, AdtValue], Result) :-
9msrVar(ptBoolean, TheResult),
10msrVar(dtReal, EarthRadius),
11msrVar(dtReal, MaxDistance),
12
13msrVar(dtLatitude, ComparedLatitude),
14msrVar(dtLongitude, ComparedLongitude),
15
16msrVar(dtReal, R1), msrVar(dtReal, R1a),
17msrVar(dtReal, R2), msrVar(dtReal, R2a),
18
19(
20(
21(
22    % msd01
23    msrNav([EarthRadius], [value], [[ptReal, 6371]]),
24    msrNav([MaxDistance], [value], [[ptReal, 100]]),
25
26    msrNav([AdtValue], [latitude], [ComparedLatitude]),
27    msrNav([AdtValue], [longitude], [ComparedLongitude]),
28
29    msrNav([Self], [latitude, sin, [], [R1a]]),
30    msrNav([AdtValue], [latitude, sin, [], mul, [R1a]], [R1]),
31
32    msrNav([Self], [latitude, cos, [], [R2a]]),
33    msrNav([AdtValue], [latitude, cos, [], mul, [R2a]], [R2]),
34
35    msrNav([AdtValue], [longitude], [ComparedLongitude]),
36    msrNav([Self], [longitude, sub, [ComparedLongitude], cos, [], mul, [R2],
37        add, [R1],
38        acos, [],
39        mul, [EarthRadius],
40        sub, [MaxDistance],
41        value, leq, [[ptReal, 0]]],
42        [[ptBoolean, true]])

```

```

43      )
44      -> TheResult = [ptBoolean,true]
45      ; TheResult = [ptBoolean,false]
46  )
47),
48 Result = TheResult
49.

```

Listing D.36: Prolog file PrimaryTypesDatatypes-dtGPSLocation-isNearTo.pl.

D.37 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLatitude-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% msd01
7msrop(dtLatitude,is,[AdtValue],Result):-%
8msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,ged,[[ptReal,-90.0]]],
12   [[ptBoolean,true]]),
13  msrNav([AdtValue],
14   [value,leq,[[ptReal,+90.0]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20Result = TheResult
21.

```

Listing D.37: Prolog file PrimaryTypesDatatypes-dtLatitude-is.pl.

D.38 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLogin-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5% dtComment
6
7%msd01
8msrop(dtLogin,is,[AdtValue],Result):-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11 (
12  (
13    (
14      MaxLength = [ptInteger,20],
15      msrNav([AdtValue],
16        [value,length,[],leq,[MaxLength]],
17        [[ptBoolean,true]]))
18  )
19  -> TheResult = [ptBoolean,true]
20  ; TheResult = [ptBoolean,false]
21 )
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567']]],[[]]]],
```

```

27msrNav([X],[is,[],[Result]) .
28X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567']]]],[],[],],
29Result = [ptBoolean,true] ?
30yes
31
32| ?- X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567a']]]],[],[],],
33msrNav([X],[is,[],[Result]) .
34X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567a']]]],[],[],],
35Result = [ptBoolean,false] ?
36yes
37*/

```

Listing D.38: Prolog file PrimaryTypesDatatypes-dtLogin-is.pl.

D.39 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLongitude-is.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5
6%% dtPhoneNumber
7
8% msd01
9msrop(dtLongitude,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12 ( msrNav([AdtValue],
13   [value,geq,[[ptReal,-180.0]]],
14   [[ptBoolean,true]]),
15 msrNav([AdtValue],
16   [value,leq,[[ptReal,+180.0]]],
17   [[ptBoolean,true]]))
18 )
19 -> (TheResult = [ptBoolean,true])
20 ; (TheResult = [ptBoolean,false])
21),
22
23 Result = TheResult
24.

```

Listing D.39: Prolog file PrimaryTypesDatatypes-dtLongitude-is.pl.

D.40 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtPassword-is.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtPassword,is,[AdtValue],Result) :-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MinLength),
11 (
12 (
13   (
14     MinLength = [ptInteger,6],
15     msrNav([AdtValue],
16       [value,length,[],geq,[MinLength]],
17       [[ptBoolean,true]]))
18   )
19   -> TheResult = [ptBoolean,true]

```

```

20      ; TheResult = [ptBoolean, false]
21  )
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtPassword, [], [[dtString, [[value, [ptString, '012345']]]], []]], 
27msrNav([X], [is, []], [Result]).
28X = [dtPassword, [], [[dtString, [[value, [ptString, '012345']]]], []]], 
29Result = [ptBoolean, true] ?
30yes
31
32| ?- X = [dtPassword, [], [[dtString, [[value, [ptString, '01234']]]], []]], 
33msrNav([X], [is, []], [Result]).
34X = [dtPassword, [], [[dtString, [[value, [ptString, '01234']]]], []]], 
35Result = [ptBoolean, false] ?
36yes
37*/

```

Listing D.40: Prolog file PrimaryTypesDatatypes-dtPassword-is.pl.

D.41 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtPhoneNumber-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% dtPhoneNumber
7
8% msd01
9msrop(dtPhoneNumber,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12  ( msrNav([AdtValue],
13    [value,length,[],gt,[[ptInteger,4]]],
14    [[ptBoolean,true]]),
15  msrNav([AdtValue],
16    [value,length,[],leq,[[ptInteger,30]]],
17    [[ptBoolean,true]])
18 )
19
20 -> TheResult = [ptBoolean,true]
21 ; TheResult = [ptBoolean,false]
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtPhoneNumber, [], [[dtString, [[value, [ptString, '(+352) 46 66 44 60 00']]]], []]], 
27msrNav([X], [is, []], [Result]).
28X = [dtPhoneNumber, [], [[dtString, [[value, [ptString, '(+352) 46 66 44 60 00']]]], []]], 
29Result = [ptBoolean,true] ?
30
31yes
32
33yes
34*/

```

Listing D.41: Prolog file PrimaryTypesDatatypes-dtPhoneNumber-is.pl.

D.42 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClassesAndAlertStatus-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */

```

```

3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% etAlertStatus
7
8% msd01
9msrop(etAlertStatus,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12 (
13 member(AdtValue,[pending, valid, invalid])
14 )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.
```

Listing D.42: Prolog file PrimaryTypesDatatypes-etAlertStatus-is.pl.

D.43 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClassifications/etCrisisStatus-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% etCrisisStatus
7
8% msd01
9msrop(etCrisisStatus,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12 (
13 member(AdtValue,[pending, handled, solved, closed])
14 )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.
```

Listing D.43: Prolog file PrimaryTypesDatatypes-etCrisisStatus-is.pl.

D.44 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClassifications/etCrisisType-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% etCrisisType
7
8% msd01
9msrop(etCrisisType,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12 (
13 member(AdtValue,[small, medium, huge]))
14 )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
```

19.

Listing D.44: Prolog file PrimaryTypesDatatypes-etCrisisType-is.pl.

D.45 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses etHumanKind-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% etHumanKind
7
8% msd01
9msrop(etHumanKind,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12(
13    member(AdtValue,[witness,victim,anonymous])
14)
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.

```

Listing D.45: Prolog file PrimaryTypesDatatypes-etHumanKind-is.pl.

D.46 File ./src-gen/prolog-ref-spec/Operations/Concepts/SecondaryTypesDatatypesdtSMS-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtSMS,is,[AdtValue],Result) :-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11(
12(
13(
14    MaxLength = [ptInteger,160],
15    msrNav([AdtValue],
16        [value,length,[],leq,[MaxLength]],
17        [[ptBoolean,true]]))
18)
19 -> TheResult = [ptBoolean,true]
20 ; TheResult = [ptBoolean,false]
21)
22),
23 Result = TheResult
24.

```

Listing D.46: Prolog file SecondaryTypesDatatypes-dtSMS-is.pl.

Glossary

| | |
|--|----|
| <i>abstract actor</i> an actor that is not | 22 |
| <i>actor</i> An actor is a person, organization, or external system that plays a role in one or more interactions with the system | 18 |
| <i>direct actor</i> an actor that interacts directly with the system. It thus belongs to the environment. | 22 |
| <i>indirect actor</i> an actor that interacts indirectly with the system through a direct actor. It thus belongs the domain but not to the environment. | 22 |
| <i>system operation</i> a functionality of the system that can be triggered by a message sent by an actor belonging to the environment. | 18 |

